Necrotizing Fasciitis After Breast Augmentation

Rapid Microbiologic Detection by Using Sonication of Removed Implants and Microcalorimetry

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ABSTRACT

Objectives: To describe the use of sonication and microcalorimetry in diagnosing necrotizing fasciitis in a 27-year-old woman with bilateral breast implants.

Methods: The removed breast implants were subjected to sonication and microcalorimetry. The microcalorimetry findings were correlated with conventional microbiologic methods. The time to detection of infection was noted.

Results: The patient had painful cellulitis of the right breast that enlarged within hours. Her C-reactive protein level was increased. Chest radiograph showed gas formation in the soft tissue lateral of the right breast. Surgery was performed: 300 mL (right breast) and 100 mL (left breast) of serous-purulent fluid were evacuated. Streptococcus pyogenes was cultured from the fluid 1 day after clinical presentation. Infection was diagnosed by microcalorimetry of sonication fluid in 1 hour and 21 minutes. The microcalorimetry curve from the right implant reached the peak earlier than did the left implant.

Conclusion: Microcalorimetry will have a benefit in conditions in which rapid diagnosis of infection is important.

Breast augmentation is one of the most common types of plastic surgery for aesthetic reasons. More than 300,000 procedures are performed per year in the United States. Infection after breast implantation is rare, especially when prophylactic antibiotics are used. Early infections typically occur within 1 month after breast implantation and are caused by highly virulent microorganisms, such as Staphylococcus aureus. When severe symptoms and signs of infection with rapid evolution occur, necrotizing fasciitis should be considered after breast implantation. It is important to diagnose necrotizing fasciitis early since aggressive surgery and appropriate antibiotics are needed. Streptococcus pyogenes is the most common cause of necrotizing fasciitis, cultured in around one-third of the cases. Yet, conventional cultures of intraoperative fluid or tissue samples usually require at least 24 hours, and Gram staining has low sensitivity (~20%).
Moreover, diagnosing the presence of microorganisms in the infection after breast implantation could be difficult since a prosthesis is involved. We present here a case of a patient who had severe infection highly suggestive of necrotizing fasciitis after breast implantation surgery. The presence of microorganisms was detected rapidly by using sonication and microcalorimetry.

**Case Report**

A 27-year-old previously healthy woman presented to the emergency department with a 2-day history of a painful and swollen right breast. One month earlier, she underwent bilateral breast augmentation surgery in her native country, Brazil. There, she did not receive antimicrobial prophylaxis before the implantation surgery. The surgery was performed with an axillary incision, and silicone gel breast prostheses were implanted between the pectoralis major muscle and the breast gland. The procedure and early postoperative course were uneventful.

On physical examination, the patient appeared lethargic and had a fever (temperature, 39.1°C), tachypnea (35 breaths/min), and tachycardia (115 beats/min). The skin over the right breast was red with bluish discoloration (10 × 5 cm) and blister formation. The whole right breast was swollen and extremely painful. The postoperative scar was unremarkable. Axillary lymph nodes were not enlarged. Laboratory evaluation revealed an increased C-reactive protein (CRP) level (177 mg/L; normal, <10 mg/L), normal leukocyte count and differential, and normal creatinine and creatine phosphokinase levels. Ultrasound of the breasts showed diffuse tissue inflammation around both implants with significant fluid collection within the capsule on both sides. No skin abscess or implant rupture was observed.

Physical examination several hours later showed enlarged cellulitis, and the patient described having unbearable pain. Chest radiograph revealed gas formation in the soft tissue lateral of the right breast. On the basis of this disease evolution, necrotizing fasciitis was suspected, and surgical intervention was performed 5 hours after presentation. The periprosthetic capsule was incised and approximately 300 mL (right breast) and 100 mL (left breast) of serous-purulent fluid were evacuated. The intraoperative aspect was highly suggestive of necrotizing fasciitis since the deep fascia and underlying muscle showed acute inflammation and multiple necrotic areas. Both breast implants were removed, and the cavity was rinsed with iodine and saline solution. Empiric treatment with amoxicillin-clavulanic acid, 2.2 g, every 8 hours intravenously was administered.

Both removed breast implants were sent for sonication and processed as previously described. Briefly, 100 mL of Ringer’s salt solution was added to each container holding the implants. The containers were vortexed for 30 seconds, followed by sonication for 1 minute at 40 kHz and at power density of 0.2 W/cm² in an ultrasound bath (BactoSonic; Baeldelin, Berlin, Germany). The resulting sonication fluid was vortexed for 30 seconds; 0.1 mL of sonication fluid was Gram stained, plated onto aerobic and anaerobic sheep blood agar plates, and incubated at 37°C for 5 and 10 days, respectively. For microcalorimetry, the sonication fluid was centrifuged at 3,000 g for 10 minutes, and the pellet was resuspended in 3 mL tryptophan soy broth in 4-mL ampoules. The ampoules were then inserted in the isothermal microcalorimeter (TAM III; TA Instruments, New Castle, DE), first in the equilibration position for 15 minutes to reach 37°C and then for another 30 minutes to get an accurate measurement of heat flow. In addition, three tissue samples were collected and cultured on aerobic (5 days) and anaerobic (10 days) blood agar plates.

Microcalorimetry of the sonication fluid became positive (ie, heat production curve passed the threshold of 10 µW) 36 minutes after the required thermal equilibration had been achieved (45 minutes after insertion of the ampoule in the microcalorimeter). This confirms the presence of bacteria but gives no identification.

**Figure 1** shows the heat flow curve produced by microbial replication in appropriate growth medium. Distilled water that serves as negative control did not show any peak within 24 hours. Gram stain of the sonication fluid showed gram-positive cocci in chains, resembling streptococci or enterococci. Gram stain of tissue samples showed high numbers of leukocytes but no visible microorganisms. On the following day, *Streptococcus pyogenes* grew from the sonication fluid in high numbers (>10⁹ colony-forming units/mL) and in one of three tissue cultures sampled from the muscle, identified by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry. On the second day, the treatment was switched to intravenous penicillin G (5 million units every 6 hours) and clindamycin (900 mg every 8 hours). On day 7, the patient was discharged from the hospital, and the treatment was switched to oral amoxicillin (750 mg every 8 hours) for an additional 3 weeks. At the follow-up visit 3 months later, the patient had no local or systemic signs of infection, and the CRP level was normal. Twelve weeks after explantation, new breast prostheses were reimplanted on both sides at our institution. At follow-up 1 and 2 years later, the patient had no complaints and was satisfied with the aesthetic result.

**Discussion**

It is important to diagnose necrotizing fasciitis early since aggressive surgery and appropriate antibiotics are needed. Patients with necrotizing fasciitis initially have severe pain...
and fever. However, local findings at an early stage may be minimal, limited to tenderness, erythema, and warmth. In our case, necrotizing fasciitis was suspected due to local signs, skin discoloration, blister formation, and the extreme pain that rapidly became worse, in combination with imaging findings, the intraoperative aspect, and the identification of the typical pathogen. In the present case, the detection of the presence of microorganisms was very fast (less than 2 hours) by using the combination of two novel techniques: sonication followed by microcalorimetry. Sonication alone increases the possibility of finding bacteria attached to foreign bodies, but it still takes at least 24 hours to have positive culture results of the sonication fluid. The Gram stain is fast but is not sensitive; in our case, the Gram stain of the tissue biopsy specimen was negative.

Microcalorimetry is an approach for fast detection of microbial growth based on growth-related heat production. An extensive review on microcalorimetry in medical microbiology was recently published. Because it can provide rapid results, microcalorimetry will have a benefit in conditions in which fast differentiation between infectious and noninfectious causes of a disease is important, for example, in differentiating septic from nonseptic arthritis (data not shown). We also recently showed that microcalorimetry of sonication fluid increases the accuracy and, most important, leads to a faster diagnosis of prosthetic joint infection. Moreover, we have tested this method in blood transfusion medicine, an area where time to detect the presence of microorganisms is critical. Although it was not performed here, microcalorimetry can also be used for susceptibility testing by measuring heat flow in the presence of different antibiotics. The barriers for the widespread clinical use of microcalorimetry are the technical aspects (eg, size of the instruments) and the price. Once these aspects are improved, the microcalorimetry can soon be a standard method in clinical microbiology.

Since the implants were bilateral, this case allows us to compare the microcalorimetry curve of the right and left implants. The heat flow curves of the implants in our case reflect clinical symptoms and signs that cannot be performed with conventional microbiologic techniques such as Gram stain and culture. The right implant reached the peak earlier than did the left implant. This can be indicative of higher bacterial load in the right than in the left implant; higher inoculum leads to faster time to positive results than does lower inoculum. Higher inoculum on the right implant is compatible with the clinical observation in which the symptoms of the right breast started earlier than those of the left breast. Moreover, the symptoms of the right side were more severe than those of the left side. In addition, more purulent fluid was recovered on the right side in comparison with the left side.

In conclusion, the present case exemplifies the potential use of microcalorimetry in acute situations where the correlation with the clinical presentation is good. It is reasonable to assume that the benefit of microcalorimetry will be even greater when the diagnosis of infection is in doubt, and this can be investigated in future trials.

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References


