Objective: To describe 10 patients with skin and soft tissue infection caused by rapidly growing mycobacteria after cosmetic liposuction and liposculpture.

Design: Case series.

Settings: Eight private geographically separate surgical facilities from a single metropolitan area.

Patients: Eight patients with definite and 2 with presumptive cases of skin and soft tissue infection caused by rapidly growing mycobacteria after cosmetic surgery procedures during a 24-month period. Microorganisms were isolated from the purulent drainage obtained from wounds or fistulas in 8 cases and were identified as Mycobacterium fortuitum (3 cases) and Mycobacterium abscessus (5 cases) by routine microbiologic techniques. Acid-fast bacilli were observed on Ziehl-Neelsen-stained smears in the 2 remaining cases, but these ultimately failed to grow. In 2 of the surgical units, no apparent environmental predisposing factors were identified after thorough microbiologic environmental investigation. Clinically, all patients exhibited signs of inflammation, microabscesses, and purulent wound drainage within 24 months of abdominal and/or thigh liposuction or homologous fat tissue injection.

Intervention: A combined therapeutic approach including surgical drainage, debridment, and prolonged (>3 months) treatment with combined antimicrobial agents including clarithromycin was used in all cases.

Results: Nine of 10 patients responded to the combined therapeutic approach, and no evidence of infection was present during at least 12 months of follow-up.

Conclusion: To our knowledge, this is the first series of patients with rapidly growing mycobacterial infections to be described after liposuction and liposculpture. Rapidly growing mycobacteria should be included in the differential diagnosis of skin and soft tissue infection after cosmetic surgery.

Arch Dermatol. 2000;136:1347-1352

FACE-LIFTING, blepharoplasty, augmentation or reduction mammoplasty, and abdominoplasty with skin and fat resection are the most common cosmetic surgical procedures performed in public and private hospitals.1 More novel interventions, such as suction of the subcutaneous fat (liposuction) and the injection of homologous fat tissue (liposculpture) obtained from the submandibular or abdominal regions, have become increasingly frequent.

As a noncontaminated elective type of surgery, cosmetic procedures in general involve a relatively low (1%-5%) risk of bacterial wound infection.2 Recovered microorganisms usually include common skin and soft tissue pathogens such as Staphylococcus aureus.3 Nevertheless, more fastidious microorganisms such as Mycobacterium fortuitum–Mycobacterium chelonae complex are occasionally identified. Most nosocomial infections caused by rapidly growing mycobacteria (RGM) occur sporadically,4-6 but outbreaks after coronary bypass surgery, face-lifting, and augmentation mammoplasty have been reported.2,7,8

We herein describe an unexpected cluster of unrelated cases of infection caused by RGM, seen during a period of 24 months, in patients who underwent liposuction and liposculpture, 2 procedures not previously known to be complicated by this type of infection.
PATIENTS AND METHODS

A case was defined as any convalescent patient seen after either liposuction or lipoinjection procedure with signs of inflammation of the skin and abscesses or drainage at the original wound site, demonstrating acid-fast bacteria by smear and/or mycobacterial culture. All patients’ conditions were diagnosed between October 1, 1996, and June 30, 1998.

The patients underwent operations at 8 surgical facilities located in diverse sections of the city of Caracas, Venezuela, by 8 unrelated surgical teams. Standard disinfection of the skin with iodophor was always carried out. All surgeons and operating room personnel assured us that no use was made of gentian violet, methylene blue, or other skin-marking solutions. Patients with clinical evidence of infection of the skin and soft tissue were sent to our group for consultation, especially after antimicrobial therapy against common infection had failed. All patients were examined and closely followed up by 1 or more of us. Monthly follow-up visits for up to 24 months were routine for all patients.

Purulent material specimens were sent to the microbiology laboratory. Ziehl-Neelsen staining method was used for direct examination. Culture media included blood agar, chocolate agar, MacConkey agar, and Lowenstein-Jensen stain for mycobacteria. Incubation at 35°C to 37°C and 28°C to 30°C, to increase the culture sensitivity, was always carried out. Isolated microorganisms were identified and tested for antimicrobial susceptibility by standard microbiologic procedures, according to the recommendations of the American Society for Microbiology. The Mycobacteria/Nocardia Research Laboratory carried out susceptibility testing of 1 of the strains at the University of Texas Health Center in Tyler. The rest of the strains were tested at the Centro Médico de Caracas Reference Microbiology Laboratory according to established routine microbiological technique.

An environmental epidemiological investigation was carried out by our infectious disease fellow (J.C.) in 2 of the 8 surgical units involved. Samples from the operating room floor, sterile and tap water, surgical equipment (suction cannulas, skin-marking solutions, demarcating pencils), and antiseptics were sent to the Centro Médico de Caracas Microbiology Laboratory for culturing.

Surgical abscess drainage and wound curettage were performed on more than one occasion in all patients when clinically necessary. All patients were treated for 3 months or longer with a combination of clarithromycin with 1 or 2 of the following antimicrobial agents according to the results of susceptibility testing: amikacin sulfate, ciprofloxacin hydrochloride, sulfamethaxazole-trimethoprim, and tetracycline hydrochloride.

A patient was considered clinically cured if a complete disappearance of all the original lesions without evidence of relapse was documented after at least 12 months of follow-up after treatment.

COMMENT

The most common diseases caused by RGM are skin and soft tissue infections. Most often, they occur after surgery, accidental penetrating trauma, intramuscular injections, and superficial abrasions in circumstances predisposing to environmental contamination of the wound with soil, water solutions, and disinfectants.

Disseminated disease has been observed in immunocompromised hosts and in patients with severe underlying disease. A large percentage of cases have occurred in patients with malignant neoplasms or patients receiving corticosteroid therapy. Others have undergone renal transplantation or were undergoing long-term hemodialysis at the time of infection. Nosocomial infections complicating surgical procedures are an important category in which M fortuitum–M chelonae complex organisms have been implicated. Sternal wound infections after cardiac bypass surgery and skin and soft tissue infections after augmentation mammoplasty have been published occasionally.

Postinjection abscesses caused by M fortuitum–M chelonae complex have been reported after the administration of commercial products (vitamins, adrenal cortex extract, and lidocaine). Mycobacterium fortuitum–M chelonae wound infections after cosmetic surgery are being reported with greater frequency every year. These infections have remained limited to mammary implants after augmentation procedures, with skin and soft tissue involvement.
### Demographic and Clinical Data of 10 Women With Skin and Soft-Tissue Infection Caused by RGM After Cosmetic Surgery

<table>
<thead>
<tr>
<th>Patient No./Age, y</th>
<th>Type of Surgical Procedure</th>
<th>Incubation Period, d</th>
<th>Predominant Clinical Manifestations</th>
<th>Microbiologic Findings</th>
<th>Treatment</th>
<th>Follow-up (12 mo or Longer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/30</td>
<td>Abdominal and posterior and anterior thigh liposuction</td>
<td>15</td>
<td>Fever, malaise, multiple abscesses along original suction tracts</td>
<td>Mycobacterium fortuitum; AFB smear negative</td>
<td>Amikacin sulfate (10 d), clarithromycin (6 mo), and abscess drainage ×2</td>
<td>Cured</td>
</tr>
<tr>
<td>2/30</td>
<td>Abdominal and posterior and anterior thigh liposuction</td>
<td>2 y</td>
<td>Multiple abdominal and thigh abscesses</td>
<td>M fortuitum; AFB smear negative</td>
<td>Amikacin (15 d), clarithromycin (9 mo), ciprofloxacin hydrochloride (3 mo), and abscess drainage ×1</td>
<td>Currently under therapy</td>
</tr>
<tr>
<td>3/28</td>
<td>Abdominal liposuction</td>
<td>7</td>
<td>Multiple abscesses along original suction tracts</td>
<td>M fortuitum; AFB smear negative</td>
<td>Amikacin (1 mo); clarithromycin, doxycycline (6 mo); and abscess drainage ×3</td>
<td>Cured</td>
</tr>
<tr>
<td>4/35</td>
<td>Abdominal liposuction</td>
<td>35</td>
<td>Multiple abscesses along original suction tracts</td>
<td>Mycobacterium abscessus; AFB smear negative</td>
<td>Amikacin (15 d), clarithromycin (4 mo), and abscess drainage ×2</td>
<td>Cured</td>
</tr>
<tr>
<td>5/37</td>
<td>Abdominal liposuction</td>
<td>30</td>
<td>Multiple abscesses along original suction tracts</td>
<td>M abscessus; AFB smear positive</td>
<td>Clarithromycin, ciprofloxacin (9 mo) and abscess drainage ×3</td>
<td>Cured</td>
</tr>
<tr>
<td>6/39</td>
<td>Bilateral fat injection into nasolabial folds</td>
<td>7</td>
<td>Erythema, induration, microabscesses along right nasolabial fold</td>
<td>M abscessus; AFB smear negative</td>
<td>Clarithromycin, doxycycline (4 mo) and abscess drainage ×3</td>
<td>Cured</td>
</tr>
<tr>
<td>7/47</td>
<td>Abdominal and posterior and anterior thigh liposuction</td>
<td>10</td>
<td>Fever, malaise, multiple abscesses along original suction tracts</td>
<td>M abscessus; AFB smear negative</td>
<td>Amikacin (10 d); clarithromycin, ciprofloxacin (5 mo); and abscess drainage ×1</td>
<td>Cured</td>
</tr>
<tr>
<td>8/49</td>
<td>Abdominal liposuction</td>
<td>45</td>
<td>Multiple abscesses along original suction tracts</td>
<td>M abscessus; AFB smear positive; Nocardia asteroides</td>
<td>Amikacin (1 mo); clarithromycin, ciprofloxacin, sulfamethoxazole-trimethoprim (18 mo); and abscess drainage ×3, followed by abdominal skin surgical resection ×2</td>
<td>Cured</td>
</tr>
<tr>
<td>9/38</td>
<td>Bilateral fat injection into nasolabial folds</td>
<td>10</td>
<td>Bilateral erythema and induration with microabscesses in nasolabial folds</td>
<td>AFB smear positive; culture negative</td>
<td>Clarithromycin, ciprofloxacin (5 mo) and abscess drainage ×2</td>
<td>Cured</td>
</tr>
<tr>
<td>10/35</td>
<td>Abdominal and anterior thigh liposuction</td>
<td>34</td>
<td>Multiple abscesses along original suction tracts</td>
<td>AFB smear positive; culture negative</td>
<td>Amikacin (1 mo), clarithromycin (6 mo), and abscess aspiration ×2</td>
<td>Cured</td>
</tr>
</tbody>
</table>

*RGM indicates rapidly growing mycobacteria; AFB, acid-fast bacteria.*

The use of contaminated marking solutions (eg, gentian violet) has been associated with wound infections after face-lifts and blepharoplasty. The cases herein reported involved 2 more recent surgical techniques: liposuction, using a sterile cannula, and liposculpture, which is the injection of fat tissue obtained from different anatomic locations (submandibular and abdominal wall) for the purpose of reducing prominent nasolabial folds. We are aware of the existence of at least 1 previous case of RGM infection after liposuction; however, clinical and epidemiological details of the case were not available.

Risk factors for these infections of the skin and soft tissue are trauma and contamination of the surgical wound. Because of the broad environmental distribution of these microorganisms, exposure to inadequately sterilized surgical supplies and contaminated solutions are additional risk factors for such infections. Therefore, the occurrence of an unexpected clustering of cases of postsurgical wound infections after clean cosmetic procedures, from several unrelated institutions, is unique in our experience.

Strains of *M fortuitum–M chelonae* complex are resistant to many disinfectants, including 10% povidone-iodine, 2% aqueous formaldehyde, and 2% alkaline glutaraldehyde. In fact, a wide spectrum of minor ophthalmologic and ear, nose, and throat surgical procedures have been complicated by *M fortuitum–M chelonae* complex infection, particularly when chemical methods are used to sterilize surgical instruments.
Quaternary ammonium compounds are considered low-level disinfectants that cannot be relied on to destroy bacterial spores and Mycobacteria and have very little place in modern high- or intermediate-level disinfectant strategies. Nonetheless, it has become common among local surgical groups performing minor ambulatory or cosmetic surgery to clean delicate instruments, such as the cannulas used in liposuction, by rinsing them with water and soap and then sterilizing by submerging them into a commercial solution of a quaternary ammonium for several hours. Although it was not possible to produce any direct evidence linking the routine use of quaternary ammonium compounds to the current cluster of cases of wound infection, the widespread local use of these rather low-level disinfectants may be a potential risk factor that deserves to be investigated further. It is notable that an additional large ambulatory cosmetic surgical practice known to strictly adhere to standard sterilization procedures, which we investigated to collect supplementary epidemiological information, has not observed a single case of postsurgical infection by RGM after 15 years of experience and more than 15,000 procedures performed (R. Galindo, MD, oral communication, June 1999).

The characteristic features of surgical wound infections caused by RGM after plastic surgery usually manifest themselves several weeks to some months after the procedure. In the current series of patients, this incubation period was within 1 to 8 weeks for 9 of the 10 patients. As in previous reports of infections caused by RGM, our patients exhibited predominantly local erythema, induration, microabscesses, and serous drainage. Fever, chills, and other manifestations of sepsis were infrequent. An important clue to suspected infection is the dehiscence of a previously closed wound or unsuccessful healing of a wound. The absence of clinical response after the administration of antimicrobial agents (eg, staphylococci, streptococci) and the sterility of routine cultures taken from the infected sites stress the need for special isolating microbiologic procedures that would expand the microbiologic spectrum to include RGM, Nocardia species, and fungi.

An example of the need is illustrated by an additional case of mixed M abscessus–N asteroides infection complicating liposuction of the abdominal wall in an otherwise healthy woman, included in the present report. Details of this case will be published elsewhere. The importance of making a precise microbiologic diagnosis cannot be overemphasized, since multiple species of RGM such as Mycobacterium smegmatis can be seen in this setting. Acid-fast smears of wound drainage are often diagnostically helpful, as in 4 of our cases, in demonstrating the offending microorganisms. The RGM will grow on blood agar, MacConkey agar, and primary isolating Mycobacteria medium (Lowenstein-Jensen) in 5 to 7 days. It is our policy and that of others to advise the microbiology laboratory of this so that the cultures will not be read as negative after 48 hours of incubation. The culture sensitivity may be enhanced by incubating not only at 35°C to 37°C but also...
at 28°C to 30°C, since some strains of M chelonae grow only after incubation at these lower temperatures.9 It should be kept in mind that some of these organisms may grow only after several weeks of incubation during primary isolation.10 The intensive use of sodium hydroxide for decontaminating sputum and other clinical specimens may inhibit the recovery of these acid-fast microorganisms.11,12

Treatment of infections caused by RGM depends on both the antimicrobial susceptibilities of the isolate and the clinical manifestation. No controlled studies have established the optimal therapeutic regimens against these bacteria. The current antimicrobial therapy, although empirical, is based on known susceptibility patterns. Severe infections can be approached initially by means of parenteral (intravenous) cefoxitin and amikacin, which provide coverage against the majority of isolates of the complex.13 If there is clinical improvement after 2 to 4 weeks of treatment, the patient can be switched to oral therapy. The initial choice of antibiotic can be readjusted once the results of susceptibility tests become available to the clinician. Clarithromycin, a macrolide with a methylated carbon in position 6 of its molecules, possesses a consistent activity against all members of the M chelonae group and against most M fortuitum strains.32-34 It may be used as a single oral therapeutic alternative to the long-term intravenous approach, avoiding prolonged and costly hospitalization.35 Even though clarithromycin is currently considered the drug of choice, experience in treating cutaneous infections caused by RGM remains limited. Wallace et al13 suggested that single-drug therapy with clarithromycin can be effective and safe when the drug is taken continuously for no less than 4½ months. Since the issue of single vs combined therapy has not been resolved by prospective clinical trials, we elected to treat all of our patients with clarithromycin in combination with other known active antimycobacterial agents.

The emergence of resistance is a concern when single antimicrobial therapy is used against this type of mycobacteria; however, it does not appear to be a frequent event when agents such as doxycycline, sulfamethoxazole, or clarithromycin are used, although resistant strains.32-34 This situation may suggest that double or triple antimicrobial therapy for mild to moderate infections is more appropriate, but more clinical data, preferably prospective, need to be gathered to establish strong recommendations. Although the duration of treatment has not been clearly defined, it does seem prudent to treat for 3 months or longer, depending on the clinical manifestation, the evolution, and the immunological status of the patient.9

It must be emphasized that skin and soft tissue infection caused by M fortuitum–M chelonae complex microorganisms can be treated successfully only through a combined approach, with surgical removal of all necrotic tissue, drainage of purulent accumulations, and antibiotic therapy, for which selection guidelines have been discussed previously.9 Wounds must be left open and packed to prevent early closure of the skin, which can result in reaccumulation of pus and the appearance of new draining fistulas.28 Early microbiologic diagnosis, combined with an adequate antimicrobial agent and a prompt surgical approach, are very important in post–cosmetic surgery wound and soft tissue infections, especially when lesions are located in exposed anatomic regions. The consequences can be not only physical, with skin deformities and disfiguring, but also psychological, with profound depression, anxiety, and anger that would affect not only the patient but also the surgical team.

We insist on adherence to standard approved sterilization procedures for surgical instruments, medical equipment, skin-marking solutions, and water supplies, as well as proper preoperative skin cleansing, since all are important factors with a definite influence on the initiation of these infections. Finally, RGM should be included in the differential diagnosis of wound and soft tissue infections after cosmetic surgical procedures.

Accepted for publication July 13, 2000.

Members of the Venezuelan Collaborative Infectious and Tropical Diseases Study Group are as follows: Jorge Murillo, MD, Lina Bofill, MD, Jaime Torres, MD, MPH & TM, Raúl Istúriz, MD, Manuel Guzmán, MD, and Julio Castro, MD.

Reprints: Jorge Murillo, MD, 6285 Sunset Dr, Suite 200, Miami, FL 33143 (e-mail: jmur2406@aol.com).

REFERENCES