CASE REPORT

Fat necrosis and polymicrobial wound infection caused partly by *Raoultella ornithinolytica* after reduction mammoplasty

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SUMMARY

Raoultella ornithinolytica is a rare opportunistic aerobic gram-negative bacillus that naturally exists in soil, water and plants. The pathogen has been described in association with diabetic foot infections, biliary infections, bacteraemia and native and prosthetic joint infections. Fat necrosis and wound infection following breast reduction surgery or other plastic surgeries caused by this pathogen have not been previously described. We present a case of bilateral fat necrosis, wound infection and dehiscence in a 24-year-old woman with no significant past medical problems. She initially had an uneventful early postoperative course but 3 weeks after surgery noticed pain and discharge from both nipple/areola area of both breasts which later developed into full-thickness fat necrosis and complete destruction of the nipple areolar complex. *R. ornithinolytica*, *Escherichia coli* and *Enterococcus faecalis* were identified from wound exudate cultures. She was treated with surgical debridement and 2 weeks of appropriate antibiotics with a favourable outcome.

with increasing pain, discharge, fever and chills, prompting in-patient admission approximately 4 weeks from her initial surgery.

Evaluation at admission showed low-grade fever of 100.3°F, heart rate 93 beats/minute and blood pressure 111/60 mm Hg. Examination of the breasts showed wound dehiscence around both nipple areolar complex with evidence of fat necrosis. The wound on the left breast appear worse compared with the right with complete destruction of the left nipple areolar complex (figures 1 and 2). Wound cultures were obtained for bacterial, fungal and mycobacterial cultures, and she was started empirically on intravenous clindamycin 600 mg every 8 hours and ciprofloxacin 400 mg intravenously every 12 hours. Fungal and mycobacterial cultures were negative but bacterial cultures grew *Escherichia coli*, *Enterococcus faecalis* and *R. ornithinolytica*. Specifically, the *R. ornithinolytica* grew on routine plate media (blood, chocolate and eosin

BACKGROUND

Raoultella ornithinolytica is a rare gram-negative bacterium that is both a human commensal and free living in the environment.¹ As a group, they have been described in several aquatic and non-aquatic environments including hospital settings.² Pathologically, they have been associated with a limited but varied number of infections but to our knowledge, no previous reports of wound infection after breast reduction surgery has been attributable to this organism. This presentation is a case of bilateral wound infection and fat necrosis following breast reduction surgery in a young immunocompetent woman which was successfully treated with antibiotics and surgical debridement.

CASE PRESENTATION

A 24-year-old woman with no significant past medical problems underwent bilateral breast reduction surgery during which 1740g and 1610g of breast tissue were removed from the right and left breasts, respectively. She initially had an uneventful postoperative course. Three weeks after her surgery, however, she reported pain and wound discharge around the nipple/areola area of both breasts. Despite treatment with oral clindamycin and daily wound care, the symptoms got worse

Figure 1 Left breast before debridement showing wound dehiscence and extensive necrosis of the fatty component of the breasts with complete destruction of the nipple areolar complex.

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Figure 2 Right breast before debridement showing wound dehiscence and fat necrosis. Part of the nipple areolar complex is still preserved.

Figure 3 Left breast after debridement showing healthy granulation tissue.

methylene blue) and was definitively identified by the MicroScan Walkway 96 plus system. All the identified pathogens were sensitive to multiple antibiotic classes, and multidrug resistance was not a significant consideration. The *R. ornithinolytica* was only resistant to ampicillin and trimethoprim/sulfamethoxazole but was sensitive to amikacin, cefazolin, cefotaxime, ceftriaxone, ciprofloxacin, levofloxacin and gentamicin.

INVESTIGATIONS

The patient's laboratory parameters at the time of admission revealed a white blood cell count of $6.9 \times 10^9/L$, haemoglobin of 10.8 g/dL, platelet count of $314 \times 10^9/L$ and creatinine of 1.0 mg/dL. Other laboratory parameters including HIV antigen/antibody testing were unremarkable.

TREATMENT

After consultation with infectious diseases team, her antibiotic regimen was changed to intravenous ampicillin and intravenous ciprofloxacin, based on the susceptibility results of all the pathogens identified. She subsequently underwent surgical debridement and bilateral wound vacuum assisted closure application to promote wound healing. Pathology of debrided breast tissue confirmed fat necrosis with acute and chronic inflammation.

OUTCOME AND FOLLOW-UP

She was discharged in stable condition on two additional weeks of oral amoxicillin and ciprofloxacin. After debridement, examination of the wound showed healthy granulation tissue (figures 3 and 4). At subsequent clinical follow-up weeks later, both breast wounds showed no drainage or signs of infection and

there was evidence of good wound healing. She eventually had a complete recovery.

DISCUSSION

Raoultella are aerobic, non-motile, gram-negative bacilli belonging to the family of Enterobacteriaceae. They are previously classified under the genus *Klebsiella* but differ in the sense that the genus uses histamine as the only source of carbon.³ *Klebsiella* on the other hand are non-histamine producers.² *Raoultella* are found in the natural environment including plants, water, soil and insects. *R. ornithinolytica*, one of the three pathogens that make up the genus '*Raoultella*' are colonisers of the gastrointestinal and upper respiratory tracts^{1 4} but have also been described in hospital environments and could therefore be associated with nosocomial infections.^{2 5} Most human infections are opportunistic and caused by *R. ornithinolytica* and *Raoultella planticola*.⁶

R. ornithinolytica as well as *R. planticola* elaborates histidine decarboxylase, an enzyme which converts histidine to histamine. Both bacteria are thus frequent causes of Scombroid or histamine fish poisoning which typically results from ingestion of decomposing fish.²

R. ornithinolytica is a rare cause of infections in humans and only a handful cases have been published to date. Infections attributable to *R. ornithinolytica* include relatively serious infections such as bacteraemia, catheter-related infections, sepsis, pneumonia, native and prosthetic joint infection, biliary infections and peritonitis.⁷⁻¹³

Wound infection associated with *R. ornithinolytica* has also been sparsely reported, especially in diabetics^{7 14} but not

Figure 4 Right breast after debridement showing healthy granulation tissue.

in relation to breast reduction surgery or associated with fat necrosis. Seng *et al* described a case series of 112 pathogenic *R. ornithinolytica* infections, out of which 13% were related to skin and soft tissue.⁵ Only one case in this series was attributable to breast abscess, but the authors did not specify whether there was any preceding breast surgery procedure. No other reports of *Raoultella* skin or soft tissue infection related to the breasts were encountered during our literature search.

The pathogenesis of *R. ornithinolytica* has been linked to different factors including formation of biofilms, production of toxins, elaboration of carbapenemases and hydrolases, as well as other virulent factors such as the polysaccharide capsule, siderophores and fimbriae.^{15–17} It has also been suggested that the presence of a chromosomal bla gene likely plays a key role in the mechanism of beta-lactam resistance attributable to *R. ornithinolytica*.^{17 18}

Microbiological identification and diagnosis is made possible with several available options including biochemical methods, Microscan (as in our case), Vitek 2 or matrix-assisted laser desorption ionisation-time of flight mass spectrometry. Some challenges with identification are, however, sometimes encountered especially with ornithine decarboxylase negative *R. ornithinolytica* strains which often requires genetic or molecular methods such as amplification of chromosomal bla, rpoB and 16s ribosomal DNA genes.^{5 15 19–21}

R. ornithinolytica are naturally resistant to aminopenicillins as typical for most *Klebsiella* isolates due to the elaboration of chromosomally mediated beta-lactamases.^{17 22} Generally speaking, however, *R. ornithinolytica* is sensitive to a good number of antibiotics (as demonstrated by our case) including

higher generation cephalosporins, piperacillin-tazobactam, carbapenems, co-trimoxazole and fluoroquinolones.^{12 14 22} Some authors have, however, reported resistance to some of these agents and multidrug resistant strains including KPC and NDM-1 have been well described.^{15 16 18 19 23} For example, antibiotic resistance in the case series reported by Seng was relatively high, up to 13% to co-trimoxazole and 6% to quinolones.⁵ Even though the *R. ornithinolytica* in our case was resistant to ampicillin, we included ampicillin and amoxicillin in the treatment regimen to provide adequate coverage for all the implicated pathogens, especially *Enterococcus*. For *Raoultella*, we suggest initial empirical antibiotic such as higher generation cephalosporin, piperacillin-tazobactam or a carbapenem pending antibiotic susceptibility. When multidrug resistance is encountered, combination therapy may be warranted.⁴

Our case had polymicrobial involvement and this observation has been previously noted by other authors.^{5 18} The source of *R. ornithinolytica* infection in our patient could be the environment and not necessarily hospital acquired as previously noted also in some reports.^{24 25}

There have been several suggested risk factors associated with *Raoultella* infections. Notable among these include: previous long-term antibiotic therapy,¹⁸ diabetes mellitus,^{7 26} cancer and chemotherapy,^{11 12 19 27 28} chronic kidney disease, intensive care unit stay, indwelling catheter²⁹ and immunodeficiency.^{8 9 30} For example, in a small series of 57 patients, Boattini *et al* reported associated immunodeficiency in 64% of *R. ornithinolytica* and 56% of *R. planticola* infections.³¹ Also, 25% of patients in the report by Seng *et al* had one form of immunodeficiency.⁵ While the statistical association between these risk factors and *Raoultella* infection in a few of these studies is proven, others appear to be weak, non-existent or not reported. None of these risk factors was present in our case.

The data accuracy of the mortality attributable to *Raoultella* infections is limited by the sparsity of cases. Mortality rate ranges broadly from 8% in larger case series to 100% in smaller series and tend to be slightly higher with *R. planticola* compared with *R. ornithinolytica* infections.^{5 18 31} Mortality tends to be high when there is associated bacteraemia and may still result despite appropriate antibiotic selection.^{19 32}

The wound infection in our case was associated with fat necrosis. Fat necrosis is a relatively uncommon complication of breast reduction surgery, ranging from 5% in a smaller series to 8% in a larger series involving 2142 breast reduction procedures.^{29 33} Needless to say, that under this circumstance, adequate surgical debridement in combination with appropriate antibiotic therapy is often necessary for a favourable outcome.³⁴

In conclusion, this case represents polymicrobial wound infection that includes *R. ornithinolytica* isolate in an immunocompetent host with no identifiable risk factors. The extensive tissue destruction may reflect the aggressiveness and virulence of this pathogen. Diagnosis could be challenging but there are several diagnostic tools available. Treatment providers should be familiar with the clinical spectrum, diagnostic and treatment options as well as the potential for multidrug resistance.

Patient's perspective

I did everything right as instructed by my surgeon, and I am very surprised and actually upset that I still develop this aggressive infection. I am, however, happy with my response to antibiotic treatment and hope other doctors learn from my experience.

Learning points

- *Raoultella ornithinolytica* is a rare, aerobic gram-negative bacillus from the Enterobacteriaceae family with some similarities to *Klebsiella*.
- *R. ornithinolytica* has been associated with different clinical scenarios but this is the first reported case of wound infection and fat necrosis after breast reduction surgery ascribable to this pathogen.
- Resistance to aminopenicillin is common and multidrug resistance is possible.
- Mortality attributable to *Raoultella* has been reported despite appropriate antibiotic management.

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