



## A Rare Agent in Wound Infection: *Leclercia adecarboxylata* Yara Yeri Enfeksiyonunda Nadir Bir Etken: *Leclercia adecarboxylata*

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### Abstract

As a rare infectious agent, *Leclercia adecarboxylata* is a gram-negative bacillus belonging to the *Enterobacteriaceae* family. It can be isolated from human blood, sterile body fluids, sputum, urine, fecal, and wound samples. In this case report, the isolation of *L. adecarboxylata* as a causative agent in the wound and tissue sample cultures of a soft tissue infection that developed after arthrodesis surgery on the right foot of a 47-year-old female patient who was followed up with Charcot foot treatment due to diabetes in our hospital is presented. The patient's general condition was good, his leukocyte count was 6000/ml, leukocyte distribution was 58% neutrophil predominance, erythrocyte sedimentation rate was 105 mm/hour, and C-reactive protein level was 90 mg/L. Wound and tissue samples from the area considered to be the focus of infection were sent to our laboratory for culture examination. In the samples inoculated into routine identification media and subjected to standard incubation and identification procedures, a growth consisting of pure colonies (*monomicrobial*) was detected on the culture media. The isolate was identified as *L. adecarboxylata* by colony morphology, microscopic examinations (gram-negative bacilli), other basic identification procedures, and mass spectrometry (MALDI-TOF MS). Since it is a rare infectious agent, additional biochemical tests were performed; glucose-sucrose-lactose utilization, motility, indole production, and esculin hydrolysis tests were found to be positive, while oxidase, ornithine decarboxylase, hydrogen-sulfide production, citrate utilization, and urease tests were found to be negative. Antibiotic susceptibility tests were performed with the VITEK 2® automated system (Biomérieux, France), and the results were evaluated according to the European Committee on Antimicrobial Susceptibility Testing (EUCAST) v13.0 criteria. The isolate, which has a generally sensitive antibiotic profile, was evaluated as the infectious agent and the patient was treated with intravenous ampicillin/sulbactam for five days. The patient, whose laboratory values tended to improve (leukocyte count 4400/ml, neutrophil rate 52.9%), was discharged with peroral amoxicillin/clavulanic acid treatment.

**Keywords:** *Leclercia adecarboxylata*, Charcot foot, Wound infection, Diabetes.

### Özet

Nadir bir enfeksiyon etkeni olarak *Leclercia adecarboxylata*, *Enterobacteriaceae* familyasına ait gram negatif bir basildir. İnsanların kan, steril vücut sıvıları, balgam, idrar, fekal ve yara örneklerinden izole edilebilmektedir. Bu olgu sunumunda, hastanemizde diyabete bağlı Charcot ayağı tedavisi ile takip edilen 47 yaşında kadın hastanın, sağ ayağında artrodez ameliyatı sonrası gelişen yumuşak doku enfeksiyonunda yara ve doku örneği kültürlerinde etken olarak *L. adecarboxylata*'nın izolasyonu sunulmuştur. Genel durumu iyi

olan hastanın lökosit sayısı 6000/ml, lökosit dağılımı %58 nötrofil hakimiyeti, eritrosit sedimentasyon hızı 105 mm/saat ve C-reaktif protein düzeyi 90 mg/L olarak saptandı. Enfeksiyon odağı olarak değerlendirilen bölgeden alınan yara ve doku örneği kültür incelemesi için laboratuvarımıza gönderildi. Rutin tanımlama besiyerlerine inoküle edilerek standart inkübasyon ve tanımlama prosedürleri uygulanan örneklerde besiyerinde saf kolonilerden oluşan (monomikrobiyal) üreme saptandı. Koloni morfolojisi, mikroskopik incelemeler (gram negatif basil), temel identifikasyon prosedürleri ve kütle spektrometresi (MALDI-TOF MS) ile *L. adecarboxylata* olarak tanımlanan izolat nadir bir enfeksiyon etkeni olduğundan ek biyokimyasal testler yapıldı ve glikoz-sukroz-laktoz kullanımı, motilite, indol üretimi ve eskülin hidrolizi testleri pozitif olarak saptanırken, oksidaz, ornitin dekarboksilaz, hidrojen sülfür üretimi, sitrat kullanımı ve üreaz testleri negatif olarak belirlendi. VITEK 2® otomatize sistemi (Biomérieux, Fransa) ile antibiyotik duyarlılık testleri yapıldı ve sonuçlar EUCAST (*European Committee on Antimicrobial Susceptibility Testing*) v13.0 kriterlerine göre değerlendirildi. Genel olarak duyarlı bir antibiyotik profili olduğu belirlenen izolat enfeksiyon etkeni olarak değerlendirildi ve hastaya beş gün süre ile intravenöz ampisilin/sulbaktam tedavisi uygulandı. Laboratuvar değerleri iyileşme eğiliminde (lökosit sayısı 4400/ml, nötrofil oranı %52.9) olan hasta peroral amoksisilin/klavulanik asit tedavisi ile taburcu edildi.

**Anahtar Kelimeler:** *Leclercia adecarboxylata*, Charcot ayağı, Yara enfeksiyonu, Diyabet.

## Introduction

*Leclercia adecarboxylata* was first described by H. Leclerc in 1962 [1]. *L. adecarboxylata* is a gram-negative, facultative anaerobic, oxidase-negative, and motile bacillus belonging to the *Enterobacteriaceae* family [2]. This bacterium, which is thought to be a member of the human intestinal flora, is found in nature, in salt water, in soil as well as in the gastrointestinal flora of farm animals [2-4]. Although it can rarely be an infectious agent in immunocompetent patients, it is generally detected as one of the polymicrobial agents [2]. Also, monomicrobial infections have been reported in immunocompromised patients or immunocompetent individuals [5,6]. This bacteria was isolated from human blood, peritoneal fluid, synovial fluid, gallbladder tissue, urine, feces, sputum, and wound samples as an infectious agent [2,3,7]. *L. adecarboxylata* was defined more frequently as the causative agent of bacteremia, wound infection, and pneumonia in catheterized patients, immunosuppressed patients, and premature newborns or associated with penetrating trauma and invasive surgical procedures in healthy individuals [2,8-10]. *L. adecarboxylata* is also closely related to *Escherichia spp.*, with the certain common biochemical characteristics and the colony morphology that is similar to *Escherichia coli* on Mac Conkey and eosin methylene-blue (EMB) agar [8,10]. According to results of biochemical characterization, DNA hybridization, and other

advanced identification methods, *Leclercia* has been accepted as a different genus within the *Enterobacteriaceae* family. However, *Leclercia* sp. can be misidentified as *Escherichia spp.* by traditional methods. Nowadays, *L. adecarboxylata* can be identified with high accuracy by new identification methods such as polymerase chain reaction, 16S rRNA gene sequence analysis, and mass spectrometry (MALDI-TOF MS) [2-4]. While the number of cases related to *L. adecarboxylata* has increased in the literature, its reporting has increased in recent years in our country with the widespread use of advanced techniques [7,11-15].

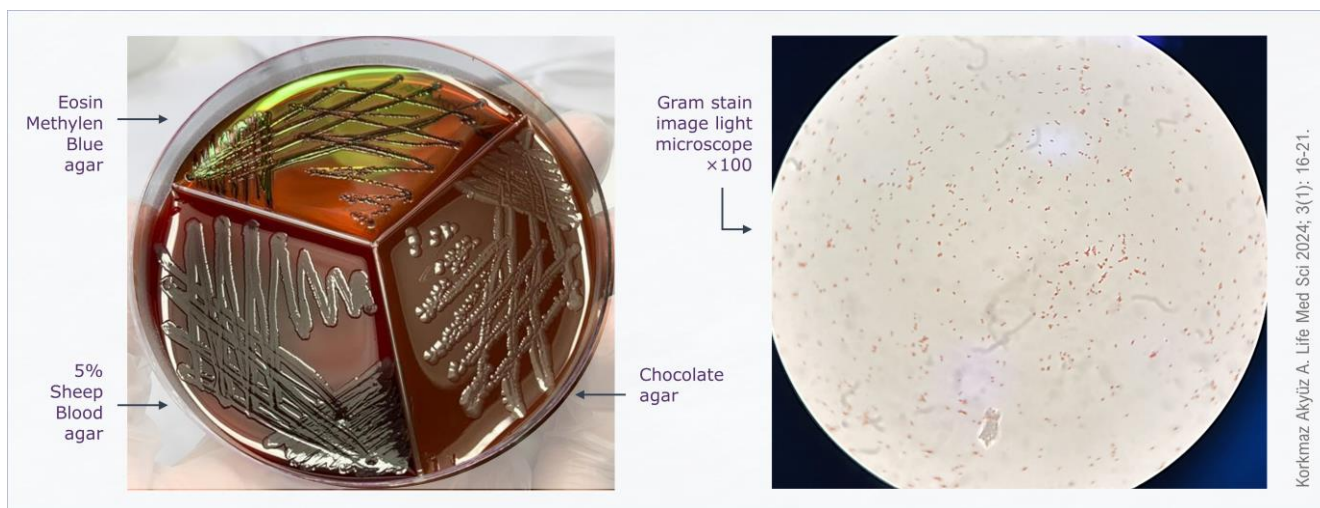
## Case Report

A 47-year-old female patient with diabetes mellitus had arthrodesis surgery two months ago due to Charcot foot and was admitted to the Orthopedics and Traumatology Clinic for further examination and treatment. The patient's general condition is good, she is oriented and cooperative, her capillary refill is complete, and her peripheral pulses are bilaterally palpable. In the movement examination, there is a deformed appearance in the right foot and there is an old incision scar and wound area on the dorsal side of the right foot.

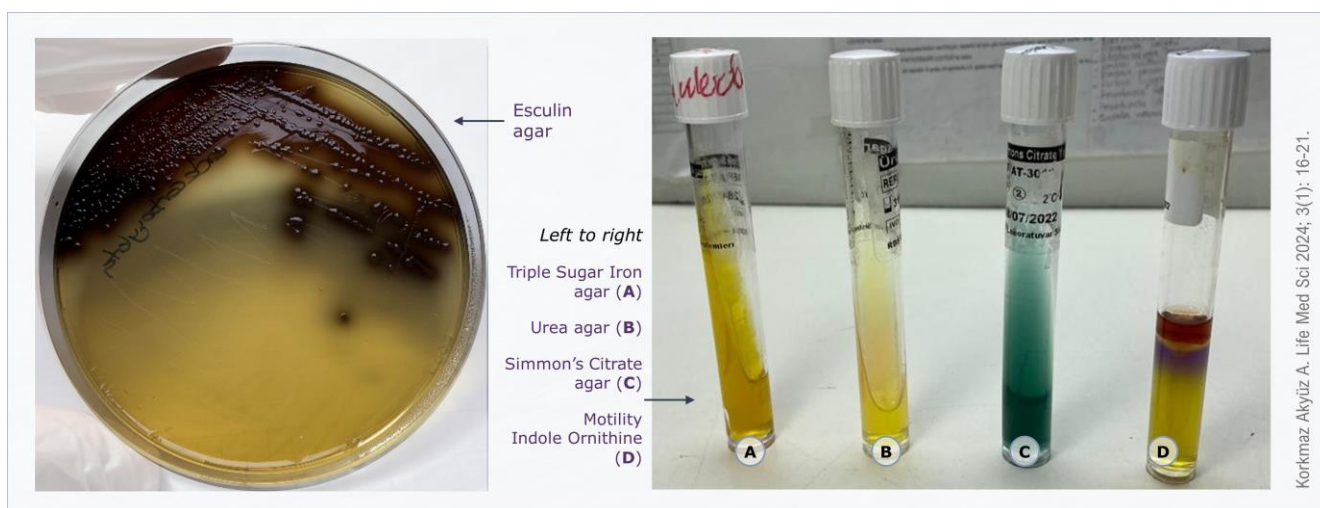
In laboratory examinations, the white blood cell count is 6000/ml and there is 58% neutrophil predominance. C-reactive protein (CRP) was 90 mg/L and sedimentation rate was 105 mm/h. On the second day of his hospitalization, wound and

tissue samples were taken from his right ankle (near the surgery region) and sent to the microbiology laboratory upon culture examination request. After the clinical sample was inoculated on 5% sheep blood agar and EMB agar, it was incubated at 35-37°C for 16-18 hours and pure monomicrobial growth was observed in all three media. Gram-negative bacilli were detected in the Gram staining performed from the culture colonies (Figure 1, right). The bacterium, thought

to be a member of the *Enterobacteriaceae* family, was identified as *L. adecarboxylata* by MALDI-TOF MS. Since *L. adecarboxylata* is a rare infectious agent, additional biochemical tests were performed. These test results were determined as follows; motility positive, indole positive, acid and gas formation from glucose and lactose positive, esculin hydrolysis positive, catalase negative, citrate negative, urease negative, ornithine decarboxylase negative (Figure 2).



**Figure 1.** Colony morphology of the *Leclercia adecarboxylata* isolate passage on different media (5% sheep blood agar, Eosin-Methylene blue agar, and chocolate agar) (left). Microscopic view ( $\times 100$  magnification) of the Gram-stained preparation (right).



**Figure 2.** *Leclercia adecarboxylata* isolate on esculin, triple sugar iron, urea, Simon's citrate, and motility indole ornithine agars. Glucose-sucrose-lactose utilization, motility, indole production, and esculin hydrolysis were positive, while ornithine decarboxylase, hydrogen-sulfide production, citrate utilization, and urease were negative.

In the disk diffusion test, it was found to be resistant to fosfomycin. The antibiotic sensitivity test was performed with the VITEK 2® automated

system (Biomérieux, France) and evaluated according to the EUCAST (European Committee on Antimicrobial Susceptibility Testing) v13.0.

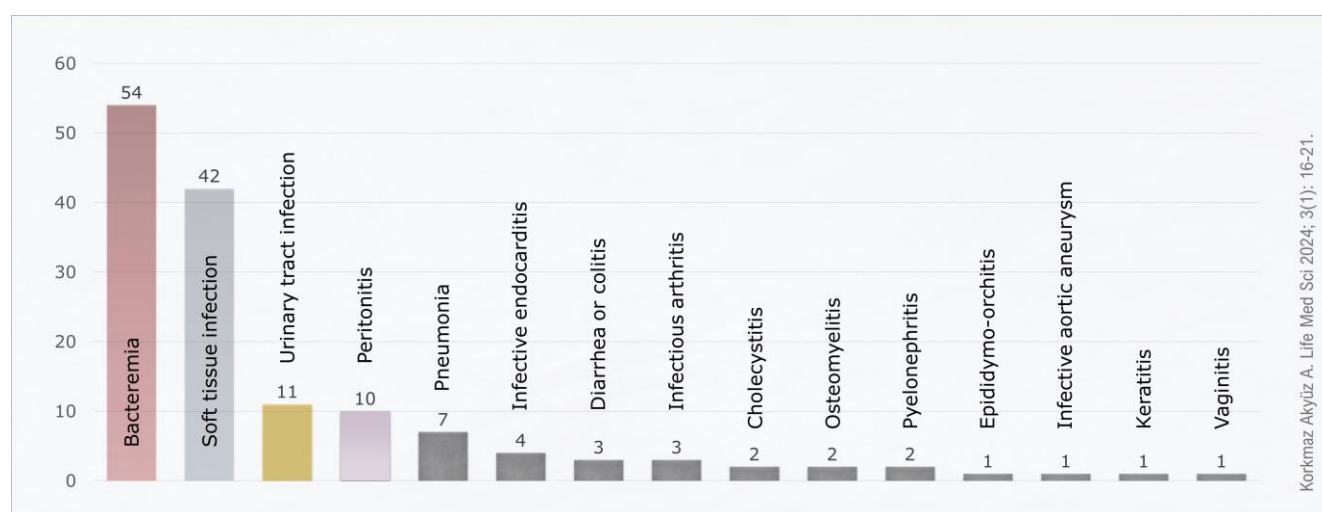
The antibiotic sensitivity test results were as follows; ampicillin, amoxicillin/clavulanic acid, ceftriaxone, ceftazidime, cefepime, ceftazidime, piperacillin/tazobactam, meropenem, ertapenem, trimethoprim/sulfamethoxazole, ciprofloxacin, gentamicin, amikacin, and colistin sensitive, while cefazolin moderately sensitive. According to antibiotic sensitivity test results the patient was treated with intravascular ampicillin/sulbactam (4×1.5 g) for five days. An improvement trend was observed in laboratory examinations after treatment; the white blood cell count was 4400/ml and there was a 52.9% neutrophil rate. The patient, whose general condition was good, was discharged on the ninth day of hospitalization with amoxicillin/clavulanic acid 2×1 g/day per oral treatment.

## Discussion

*L. adecarboxylata*, which is generally considered a nonpathogenic species, has the potential to be classified as an emerging pathogen

with the increasing number of cases in the literature especially in the immunocompromised population and also the small epidemics it causes [2,14].

*L. adecarboxylata* can be detected as a contaminant or a flora member, however, it is also isolated in clinical samples and defined as an infectious agent. When the articles published in the literature between 1991 and 2023 were reviewed [2,3,5-7,11-13,16-41] (mainly published in the PubMed database), the regions where *L. adecarboxylata* was most frequently identified as the infectious agent were as follows; 144 infection foci were detected in 135 different patients, including our case: The most common infection types were determined as following order; bacteremia, soft tissue/wound infections, urinary tract infections, peritonitis, and pneumonia. Infective endocarditis, diarrhea/colitis, infectious arthritis, cholecystitis, osteomyelitis, and pyelonephritis are some of the other notable infection types (Figure 3).



**Figure 3.** A total of 144 *Leclercia adecarboxylata* infection sites in 135 different patients including the present case, from 1991 to 2023. Data were collected from other reviews and the current case reports excluding repeated cases [2,3,5-7,11-13,16-41] (mainly published in the PubMed database). **Soft tissue infections:** Skin, abscess, folliculitis, cellulite, wound, postoperative incision site, necrotizing fasciitis. **Bacteremia:** Sepsis, catheter-related bacteremia, with and without any infection site. Data from two epidemics (in 2021 and in 2023) related to total parenteral nutrition reported from Mexico were not added to this graphic due to the different transmission routes and infection patterns [14,15].

*L. adecarboxylata* has many features similar to *E. coli*. It becomes difficult to distinguish *L. adecarboxylata* from *E. coli* due to both the colony morphology it forms in media used in routine

culture and the similar reactions it produces in basic biochemical tests [14]. However, it can be distinguished from *E. coli* by specific biochemical tests such as its growth in a medium containing

potassium cyanide, its use of malonate, the formation of yellow pigment in some strains, and sometimes its urease positivity [8]. Another distinguishing feature of this bacterium, unlike *Enterobacteriaceae* members, is its natural intrinsic resistance to fosfomycin, with the resistance feature encoded by the *fosA<sup>LA</sup>* gene [3,14]. Also a recent article reported an isolate exhibiting plasmid-borne carbapenem resistance [4]. Many different resistance patterns, which exhibit variable antibiotic resistance profiles, have been reported for this bacterium [2], although the organism is generally sensitive to most antibiotics, strains resistant to multiple antibiotics have also been reported [18]. In our case, the causative strain was found to be moderately

sensitive to cefazolin and sensitive to all other antibiotics tested.

## Conclusion

*L. adecarboxylata* has been reported as the causative agent of infection in an increasing number of cases in recent years. Although it is a rare pathogen, its reporting rate has recently increased with the widespread use of advanced diagnostic techniques including MALDI-TOF MS. Microbiology laboratories should be careful about this bacterium, which is rarely isolated and identified, and it should be kept in mind that this bacterium can cause serious infections including bacteremia, soft tissue/wound infections, urinary tract infections, peritonitis, and pneumonia.

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