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# FIRST ISOLATION OF *ESCHERICHIA HERMANNII* IN A PATIENT WITH SEPTIC PSEUDARTHROSIS AT THE UNIVERSITY HOSPITAL OF MARRAKECH AND THERAPEUTIC IMPLICATION

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## ABSTRACT

Escherichia hermannii is an extremely rare invasive infection aetiological agent, and to this day this strain remains almost unidentified in Morocco.

Our 21-year-old patient was operated on for a closed fracture of the middle third of the right leg and then lost to follow-up. Eight months later, the patient presented to the trauma department with septic pseudarthrosis of the operated leg that exposed the middle third of the tibia. Following his readmission, specimens containing material were sent to the microbiology laboratory for analysis. Investigations concluded positive in vitro cultures (polymicrobial): pus and bone (Escherichia hermannii, Staphylococcus aureus) and screws (Escherichia hermannii, Pseudomonas aeruginosa).

We report the first identification of the Escherichia hermannii strain in the biology department, Ibn Tofail Hospital, University Hospital Centre (CHU) Mohammed VI of Marrakech.

Gram-negative rods were collected, without spore formation, oxidase negative, catalase positive. A biochemical study on the Api 20E gallery (Bio Mérieux) with data analysis on the UPBM le Lab site "http://lab.upbm.org/identifieur/galerie.php" allowed the identification of Esherichia hermannii with a 98.9% probability of "excellent identification" and the vivid appearance of a yellowish pigment at 48 hours on chocolate agar.

Following the antibiotic susceptibility test, performed by the agar diffusion technique according to the recommendations of the French Society of Microbiology (SFM), all antibiotics tested were sensitive except ampicillin and ticarcillin; and piperacillin "sensitive at high dosage = Intermediate", the patient was put on ciprofloxacin and gentamicin with a favourable evolution.

**Keywords:** *Esherichia hermannii*; Gram negative; Yellow pigment; Septic pseudarthrosis

## INTRODUCTION

Infections of open tibia fractures are frequently polymicrobial, caused by multidrug-resistant organisms and leading to reoperation, limb salvage failure and poor prognosis for patients (1).

In Morocco *Escherichia coli* (*E. coli*) remains by far the most isolated Enterobacteriaceae with 65% (2). Initially considered an *E. coli-like* biogroup and classified in enteric group 11 by the enteric section of the Centers for Disease Control (CDC), Brenner et al. proposed the name of this yellow-pigmented microorganism, *Escherichia hermannii* (*E. hermannii*));a species distinct from the genus *Escherichia* (3).

Wounds account for almost 50% of human *E. hermannii isolates*, followed by sputum or lung isolates (approx. 25%) and stool isolates (20%) (3).

*Escherichia hermannii* is an extremely rare etiological agent of invasive infection. In our various bibliographic searches, we note that *Escherichia hermannii* remains undescribed in Morocco to this day.

We report the first identification of the *E. hermannii* strain in the microbiology department, Ibn Tofail Hospital (HIT), Mohammed VI University Hospital, Marrakech. This strain was isolated from a septic pseudarthrosis of the leg and was associated with *Staphylococcus aureus* (*S. aureus*) and *Pseudomonas aeruginosa* (*P. aeruginosa*). We describe the biological features and review the literature.

**OBSERVATION**

Our case is a 21-year-old patient who underwent surgery for a closed fracture of the right middle leg and received antibiotic prophylaxis with amoxicillin and clavulanic acid. Lost to follow-up, our patient returned to the trauma department eight months later with a septic pseudarthrosis exposing the middle third of the tibia of the operated leg (See figure 1).

***Figure 1****: Septic pseudarthrosis of the middle third of the right leg*

After his readmission to the trauma department, a new surgical procedure was performed to remove the medical implants. These intraoperative samples consisting of pus, bone, and material (screw-nail) were sent to the microbiology laboratory for cytobacteriological examination.

In the laboratory, the different samples were processed separately. The pus was inoculated using the swabbing technique. As for the bone in a heart-brain broth and incubated at 37°Celsius and the next day the seeded suspension. The material (screw-nail) was discharged into sterile saline and then inoculated by the swabbing method. The samples were inoculated on different enriched and standard culture media.

Cultures on Columbia blood agar, chocolate agar and McConkey medium incubated under aerobic conditions at 37° Celsius were positive and polymorphic, and Chapman medium was positive and monomorphic. Separation and subculturing of the different colonies on new culture media allowed us to have pure colonies for biochemical study and antibiogram.
We found pus (*E. hermannii*, *S. aureus*), bone (*E. hermannii*, *S. aureus*) and screw-nail material (*E. hermannii*, *P. aeruginosa*) with meticillin-sensitive *S.aureus* and a multi-sensitive *P. aeruginosa*.
*E. hermannii*, which we will describe in this work, was present in all three types of samples.

One colony collected was plated on the culture medium, another spread on a slide and stained with Gram stain to reveal large numbers of Gram-negative rods under the microscope.
For the biochemical study:
Oxidase test (impregnated absorbent paper disc) was negative.
An Api 20E gallery (Bio Mérieux) prepared by mixing colonies in a solution of API Suspension Medium (5 ml) to obtain a turbid suspension of 0.5 McFarland. The microorganism fermented glucose, mannose, rhamnose, amygdalin and arabinose and was also positive for indole and ornithine decarboxylase production. Inositol, sorbitol, sucrose and melibiose were negative as well as citrate, lysine decarboxylase and the Voges-Proskauer reaction.

The data obtained from the Api 20E gallery (Bio Mérieux) was analysed on the online application UPBM le Lab "http://lab.upbm.org/identifieur/galerie.php" with an identification of *Esherichia hermannii* for a 98.9% probability of "excellent identification"(See Figure 2).

***Figure 2:*** *Api 20E gallery (Bio Mérieux) identification of E. hermannii with a probability of 98.9%*

The clear appearance of a yellowish pigment at 48 hours on blood agar and chocolate agar reinforces the case for *E. hermannii* (See figure 3).

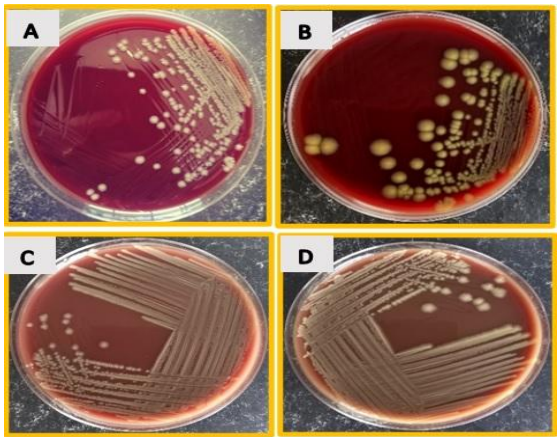


***Figure 3:*** *Esherichia hermannii colonies: A (24 hours) and B (48 hours) on blood agar; C (24 hours) and D (48 hours) on chocolate agar.*

An antibiogram using the agar diffusion technique according to the recommendations of the French Society of Microbiology (SFM), showed sensitivity to all antibiotics tested except ampicillin and ticarcillin; and piperacillin "sensitive at high dose = intermediate".

For the purpose of the study, we performed a strain identification on the BD Phoenix M50 at the Avicenne Military Hospital in Marrakech, which confirmed *Escherichia hermannii* with a confidence value of 99%.

The therapeutic management of the patient consisted of removal of the medical devices, and antibiotic therapy with ciprofloxacin and gentamicin with a favourable result.

The investigation conducted at the microbiology laboratory of Ibn Tofail hospital concluded that polymicrobial cultures were present, including *E. hermannii* in all specimens, *S. aureus* in the pus and bone and *P. aeruginosa* in the screw-claw.

## DISCUSSION

Initially considered non-pathogenic, but our case with previously reported cases in the literature shows that it could be a pathogen.

The organism is mainly isolated from the environment, including sporadic recovery from clinical specimens such as wound samples, sputum, and faeces (3,4). These sources of isolation differ from those of *E. coli*, which is most commonly isolated from faeces, the urinary tract, the respiratory tract and, less frequently, blood (3).

The literature suggests that *E. hermannii* infections are becoming increasingly common (5). It is often found as a co-infector rather than the sole cause of infection in humans (4).
Pathogenicity is unknown but may be related to biofilm formation, which is a particularly virulent problem for patients with medical implants.

*E. hermannii* is an extremely rare aetiological agent of invasive infections, and the bacterium is primarily an opportunistic pathogen (6).

*E. hermannii* is a Gram-negative, oxidase-negative, catalase-positive, sporeless rod, motile, KCN-positive, and cellobiose-positive organism where only the yellow pigment separates it from all Enterobacter species and occasionally from a strain of *E. coli* (3).

Patients infected with *E. hermannii* can be treated by removal of medical devices and antibiotic treatment (7) as was the case in our patient (removal of devices mentioned in the observation) and antibiotic therapy.

The organism is inherently resistant to penicillin, ampicillin and carbenicillin due to its production of beta-lactamase, these characteristics were present in the strain isolated from our patient (resistant to ampicillin, ticarcillin, sensitive to high dose piperacillin and sensitive to other commonly used antibiotics).

Reviews of patients with *E. hermannii* showed that these patients were treated mainly with cephalosporins, aminoglycosides, quinolones and piperacillin-tazobactam (8), which was consistent with the molecules used in our patient (ciprofloxacin and gentamycin), with good progression.

The susceptibility profile was consistent with previous data, suggesting that *E. hermannii* produces a class A chromosomal β-lactamase that confers resistance to aminopenicillins but not to β-lactam inhibitor combinations or cephalosporins (9).

## CONCLUSION

*Escherichia hermannii*is an extremely rare etiological agent of invasive infections, and the bacterium is primarily an opportunistic pathogen. Our work opens the way for further and more exhaustive studies to encourage practitioners to look for this gram-negative, non-spore-

forming, oxidase-negative, catalase-positive bacillus, where only the yellow pigment separates it from other Enterobacteriaceae. The latter remains a strain sensitive to all antibiotics tested except ampicillin and ticarcillin, and a high dose sensitivity to piperacillin.

## POTENTIAL CONFLICT OF INTEREST

None declared.

## AUTHORS CONTRIBUTION

All authors have contributed to the conduct of this work. All authors also declare that they have read and approved the final version of the manuscript.

## ETHICAL CONSIDERATION

All the data has been collected anonymously following patient confidentiality.

## REFERENCES

[1] Yin P, Ji Q, Li T, Li J, Li Z, Liu J, et al. A Systematic Review and Meta-Analysis of Ilizarov Methods in the Treatment of Infected Nonunion of Tibia and Femur. Williams BO, éditeur. PLOS ONE [Internet]. 3 nov 2015 [cité 10 juill 2021];10(11):e0141973. Available at : https://dx.plos.org/10.1371/journal.pone.0141973

[2]Arsalane L. Les entérobactéries productrices de bêtalactamases à spectre élargi (BLSE) : Profil épidémiologique actuel and thérapeutiques conséquences- Recherche Google

[3] Atypical biogroups of *Escherichia coli* found in clinical specimens and description of *Escherichia hermannii* sp. nov [Internet]. [cité 10 July 2021]. Disponible sur : https://journals.asm.org/doi/epdf/10.1128/jcm.15.4.703-713.1982

[4] Pien FD, Shrum S, Swenson JM, Hill BC, Thornsberry C, Farmer JJ. Colonization of human wounds by *Escherichia vulneris* and *Escherichia hermannii*. J Clin Microbiol [Internet]. août 1985 [cité 11 juill 2021];22(2):283‑5. Disponible sur : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC268376/

[5]Haasdijk RA, van Ingen J. *Escherichia hermannii* as the sole pathogen in urosepsis: case report. New Microbes New Infect [Internet]. 1 January 2018 [cité 11 juill 2021];21:100‑1. Available at: https://www.sciencedirect.com/science/article/pii/S205229751730094X

[6] Rank CU, Lommer Kristensen P, Schrøder Hansen D, Brandi L. Catheter Related *Escherichia hermannii* Sepsis in a Haemodialysis Patient. Open Microbiol J [Internet]. 2 february 2016 [cité 11 juill 2021];10:1‑3. Disponible sur: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4780465/

[7] Compton J, Wynn M, Willey MC, Sekar P. *Escherichia hermannii* as the sole cause of osteomyelitis in a patient with an open tibial shaft fracture. BMJ Case Rep CP [Internet]. 1 nov 2019 [cité 11 juill 2021];12(11):e231206. Available at: https://casereports.bmj.com/content/12/11/e231206

[8] Ioannou P. *Escherichia hermannii* Infections in Humans: A Systematic Review. Trop Med Infect Dis [Internet]. mars 2019 [cité 11 juill 2021];4(1):17. Disponible sur: https://www.mdpi.com/2414-6366/4/1/17

[9]Stock I, Wiedemann B. Natural antibiotic susceptibility of *Escherichia coli*, Shigella, *E.vulneris*, and *E. hermannii* strains. Diagn Microbiol Infect Dis. mars 1999;33(3):187‑99.