Original Investigation / *Özgün Araştırma*

**DOI:** 10.5578/ced.20229606 • *J Pediatr Inf 2022;16(4):e260-e263*

# *Stenotrophomonas maltophilia* Pseudobacteraemia in a Pediatric Hospital Associated with Contaminated Citrated Tubes: Importance of Appropriate Blood Collection

## Kontamine Sitratlı Tüplerle İlişkili *Stenotrophomonas maltophilia* Psödobakteriyemisi: Uygun Kan Almanın Önemi

Tuğba Erat[1] (İD), Aysun Yahşi[1] (İD), Tuğçe Tural Kara[1] (İD), Halil Özdemir[1] (İD), Ahmet Derya Aysev[2] (İD), Ergin Çiftçi[1] (İD), Erdal İnce[1] (İD)

[1] *Department of Pediatric Infectious Diseases, Ankara University Faculty of Medicine, Ankara, Türkiye*
[2] *Laboratory of Microbiology, Ankara University Faculty of Medicine, Ankara, Türkiye*

**Cite this article as:** Erat T, Yahşi A, Tural Kara T, Özdemir H, Aysev AD, Çiftçi E, et al. *Stenotrophomonas maltophilia* pseudobacteraemia in a pediatric hospital associated with contaminated citrated tubes: Importance of appropriate blood collection. J Pediatr Inf 2022;16(4):e260-e263.

**Abstract**

**Objective:** Pseudobacteraemia is the occurence of false positive blood culture and might lead to initiate unnecessary therapies and healthcare resources. In this report, *Stenotrophomonas maltophilia*-associated pseudobacteraemia is defined as a result of contamination of the syringe tip with the citrated coagulation tubes without blood culture cultivation.

**Material and Methods:** *S. maltophilia* was isolated from blood cultures of 14 patients within two months in our hospital, Türkiye. Identification of the *S. maltophilia* species was performed using conventional methods (Bactec 9240 -Becton Dickinson).

**Results:** We suspected pseudobacteraemia because of some patients had no clinic, laboratory findings for sepsis. Blood cultures were taken during hospitalization due to the fact that the patients were hospitalized in the intensive care unit or patients at risk of bacteremia such as hematology and oncology, and clinical deterioration such as fever and/or their own clinical disease activation. Environmental culture samples were taken to find the source of pseudobacteraemia. *S. maltophilia* did not grow in any of them. Since there was no growth in environmental cultures, other blood tests taken simultaneously with the blood culture were questioned and cultures were taken from the test tubes. *S. maltophilia* with the same antibiogram as trimethoprim sulfamethoxazole resistant fluoroquinolone susceptible was isolated from blood culture growths in all citrated coagulation tubes.

**Conclusion:** In this study, it is aimed to emphasize the importance of the steps that should be applied while taking blood culture

**Keywords:** Blood culture, pediatrics, pseudobacteraemia, *Stenotrophomonas maltophilia*

**Öz**

**Giriş:** Psödobakteriyemi, kan kültürünün yanlış pozitifliğidir. Gereksiz tedavilerin ve sağlık kaynaklarının kullanılmasına sebep olur. Bu çalışmada, bir çocuk hastanesinde steril kelebek seti ile kan alındıktan sonra enjektör ucunun kan kültürü ekimi yapılmadan sitratlı koagülasyon tüpü ile kontamine edilmesi sonucu gelişen *Stenotrophomonas maltophilia* ilişkili psödobakteriyemi tanımlanmaktadır.

**Gereç ve Yöntemler:** Hastanemizde iki ay içinde 14 hastanın kan kültüründen *S. maltophilia* izole edilmiştir. *S. maltophilia* türlerinin tanımlanması, geleneksel kan kültürü yöntemleri (Bactec 9240 Becton Dickinson) kullanılarak gerçekleştirilmiştir.

**Bulgular:** Hastaların klinik ve laboratuvar bulguları birlikte değerlendirildiğinde sepsis/bakteriyemi ile uyumlu olmaması nedeni ile psödobakteremiden şüphelenildi. Hastaların çocuk yoğun bakım ünitesinde yatması veya hematoloji ve onkoloji gibi bakteriyemi açısından riskli hastalar olması, ateş ve/veya kendi klinik hastalık aktivasyonu gibi klinik bozulma olması nedeniyle hastaneye yatış sırasında kan kültürü alınmıştır. Psödobakteriyemi kaynağının bulunmasına yönelik çevresel kültür örnekleri alındı, hiçbirinde *S. maltophilia* üremedi. Çevresel kültürlerde üreme olmaması nedeniyle kan kültürü ile eş zamanlı alınan diğer kan tetkikleri sorgulanarak tetkik tüplerinden kültür alındı. Sitratlı pıhtılaşma tüplerinin tamamında kan kültür üremeleri ile benzer şekilde trimetoprim sulfametaksazol dirençli florokinolon duyarlı aynı antibiyograma sahip *S. maltophilia* izole edildi.

**Sonuç:** Bu çalışmada kan kültürü alınırken uygulanması gereken basamakların önemi vurgulanmak istenmiştir.

**Anahtar Kelimeler:** Kan kültürü, pediyatri, psödobakteriyemi, *Stenotrophomonas maltophilia*

**Correspondence Address/Yazışma Adresi**

**Tuğba Erat**

Ankara Üniversitesi Tıp Fakültesi,
Çocuk Enfeksiyon Hastalıkları Anabilim Dalı,
Ankara-Türkiye

**E-mail:** tugbacancan84@hotmail.com

**Received:** 07.02.2022 **Accepted:** 19.05.2022 **Available Online Date:** 14.12.2022

## Introduction

Pseudobacteraemia is the occurence of false positive blood culture. Several studies have defined non-sterile blood collection tubes as the origin for contaminating microorganisms in outbreaks of pseudobacteraemia. Arterial or venous blood collection from patients is done with a sterile blood collection set (butterfly set). After taking blood from the sterile injector attached to the tip of the sterile blood collection set, it is necessary to inoculate the blood culture bottle without compromising the sterility of the injector tip. When talking about the concept of non-sterile blood culture, what is meant is the contamination of the sterile syringe tip with the environment, which will lead to deterioration of sterility without blood culture cultivation. Microorganisms are thought to be transferred from the non-sterile tubes to the blood culture tubes when blood is drawn for cultures. Pseudobacteraemia might lead to initiate unnecessary therapies and waste of healthcare resources (1-3). *S. maltophilia* is a nosocomial pathogen and is commonly isolated in the hospital environment (4,5). Several infection, colonization, outbreak and pseudo-outbreak by *S. maltophilia* have been previously reported (4-7). Within a two-month of period at our hospital, 14 patients' blood cultures had resulted positive for *S. maltophilia*. In this report, we describe a pseudobacteraemia of *S. maltophilia* in pediatric hospital.

## Materials and Methods

*S. maltophilia* was isolated from the blood culture of 14 patients within a two month in our hospital. The outbreak occured in a 270-bed children hospital. Seven of the patients were hospitalized in pediatric intesive care unit (PICU), two of them in pediatric hematology-oncology department, one of them in bone marrow transplantation unit (BMTU), two of them in pediatric gastroenterology, one of them in pediatric emergency department and one of them in rheumatology department. Ten of the positive cultures were drawn at the time of the first admission and seven of these patients were admitted to PICU. The causes of hospitalization in PICU included propionic acidemia with metabolic coma, hypertensive encephalopathy, status epilepticus, off-vehicle traffic accident, operated biliary atresia, operated esophagus atresia, congenital heart disease and pulmonary edema.

Thirty-eight environmetal samples were collected to determine *S. maltophilia*. Eighteen of them were the hands of medical staff who were nursing the patients. In addition cultures were collected from medical solutions, disinfectants and taps.

Identification of the *S. maltophilia* species was performed using conventional methods (Bactec 9240, Becton Dickinson Diagnostic Instrument Systems, Sparks, Md.). Species identification and antimicrobial susceptibility testing are performed in local laboratories according to European Committee on Antimicrobial Susceptibility Testing (EUCAST, https://eucast.org) or Clinical and Laboratory Standards Institute (CLSI, https://clsi.org) guidelines (8-10).

## Results

Within a two-month of period at our hospital, 14 patients' blood cultures had resulted positive for *S. maltophilia*. Patient characteristics and underlying diseases are given in Table 1. Because 11 patients had no clinic and laboratory findings for sepsis, pseudobacteraemia was also suspected. The second blood cultures drawn before initiation of antibiotics were negative. Thirty-eight environmetal samples were collected. Eighteen of them were the hands of medical staff who were nursing the patients. In addition cultures were collected from the isotonic solution shared for medicine preparation, 5% dextrose, heparin solution, the taps of PICU, respiratory circuits, axillary, umbilical, throat and perirectal swab cultures of two patients in the PICU, disinfectants, patient blankets, room furniture, floor, common dispensing area and emergency vehicle, mechanical ventilator moisturizing lotions and oxygen flowmeter solution. *S. maltophlia* did not grow in any culture. It was remarkable that the new blood cultures were reported as positive and *S. maltophilia* was isolated in the blood culture of a patient presented to pediatric emergency department with familial Mediterranean fever attack. Since there was no isolation in environmental cultures, other blood tests taken simultaneously with the blood culture were questioned and cultures were taken from the test tubes.

When the blood collection technique was questioned, it was found that hemogram, biochemistry and coagulation tests were simultaneously performed. The solution of these tubes were cultured and *S. maltophilia* was isolated in all of the citrated coagulation tubes. When the phlebotomists were questioned, we learned that, practice of taking blood specimens for culturing, hemogram, biochemistry, and coagulation profile together. After the blood samples were collected, they were first filling hemogram and coagulation tubes in order to avoid blood coagulation and then performing blood culture cultivation.

## Discussion

*S. maltophilia* is known as an opportunistic and nosocomial pathogen that can cause an invasive and fatal infection, especially in hospitalized and immunocompromised patients.

**Table 1.** Patient characteristics and underlying diseases

| Patient | Service | *Axillary Temperature (°C) | Diagnosis | Antibiotic Treatment for Positive Blood Culture |
|---|---|---|---|---|
| Patient 1 | Oncology | 38.0 | *AML | Levofloxacin |
| Patient 2 | *BMTU | 37.2 | Bone marrow transplantation for *SCID | Levofloxacin |
| Patient 3 | *PICU | 36.9 | Postoperative esophageal atresia | Levofloxacin |
| Patient 4 | *PICU | 37.4 | Epileptic status | Levofloxacin |
| Patient 5 | *PICU | 37.2 | *MR, epilepsy, hypertension | No antibiotic |
| Patient 6 | *PICU | 37.0 | Congenital hearth disease with respiratory distress | Levofloxacin |
| Patient 7 | Rheumatology | 38.1 | Vasculitis | Levofloxacin |
| Patient 8 | Gastroenterology | 37.5 | Malnutrition | No antibiotic |
| Patient 9 | *PICU | 36.8 | Traffic accident injuries | No antibiotic |
| Patient 10 | *PICU | 37.1 | Metabolic syndrome | Levofloxacin |
| Patient 11 | Gastroenterology | 37.3 | Postoperative biliary atresia | No antibiotic |
| Patient 12 | Emergency | 38.6 | *FMF | No antibiotic |
| Patient 13 | Oncology | 37.9 | *B-cell ALL | Levofloxacin |
| Patient 14 | *PICU | 37.3 | Propionic acidemia | Levofloxacin |

*AML: Acute myeloid leukemia; B-cell ALL: B-Cell acute lymphoblastic leukemia; BMTU: Bone marrow transplantation unit; FMF: Familial mediterranean fever; MR: Mental retardation; PICU: Pediatric intensive care unit; POST-BMT: Post-bone marrow transplant; SCID: Severe combined immunodeficiency disease.
* Maximum degree of axillary temperature (date of positive blood culture).

*S. maltophilia* is a significant nosocomial pathogen. Infection, colonization, outbreak and pseudooutbreak have been previously reported (4-7). In a study examining 68 bacteremic patients, hospitalization in the ICU and neutropenia were found to be risk factors for *S. maltophilia*-related mortality (11). Antibiotics were started in our patients because they had an underlying disease, were neutropenic, and had risk factors such as intensive care admission.

We report *S. maltophilia* pseudobacteraemia in our hospital. Pseudobacteraemia was suspected, because majority of patients with positive blood culture have no sepsis clinic and at the same time the blood cultures collected before initiation of antibiotherapy were negative. Previously, Park et al. have described pseudobacteraemia with *S. maltophilia* and isolated the bacteria from showerhead (4). In another study, Siebor et al. found that the disinfectant was colonized and the night staff were immersing the blood culture with this disinfectant before the cultivation (12).

When the literature data was scanned, pseudobacteraemia as a result of citrated coagulation tube contamination was defined. *Achromobacter insuavis*, *Serrati marcescens* and *Pseudomonas fluorescens* were found to be the causative agents (13-15).

The environmental samples did not reveal colonization of *S. malthophilia* in our hospital. Upon culture positivity continued in the new patients and again these patients had no clinic and laboratory findigs for sepsis, the other blood tests collected concurrently with the blood culture were questioned and it was found that hemogram, biochemistry and coagulation tests were collectively performed. Trimethoprim sulfamethoxazole resistant fluoroquinolone susceptible *S. maltophilia* grew in citrated coagulation tubes and blood cultures. We realized that health care workers were first filling hemogram and coagulation tubes in order to avoid blood coagulation. In addition, they were performing blood culture cultivation without changing the syringe needle. After blood is drawn from the sterile syringe, the syringe tip must be inoculated into the blood culture bottle without sacrificing its sterility. Numerous studies have demonstrated pseudodooutbreak caused by nonsterile blood culture collection. Neil et al. found that citrated coagulation tubes were contaminated with *Ewingella americana* and that cases of pseudobacteraemia were associated with the practice of taking concurrent blood specimens for culturing and coagulation profile (2). Although standard practice is to fill blood culture tubes first with a sterile needle, some healthcare staff, fearing that the blood would clot, filled the coagulation tubes first.

Nine patients were given levofloxacin therapy because of the hospitalization in PICU and underlying diseases. Six patients received levofloxacin for seven days, two patients for 10 days, and one patient for three days. TMP-SMZ and fluoroquinolones are traditionally the drugs of choice in the treatment of *S. maltophilia*. However, increasing resistance and drug side effects are reported. Our isolates of *S. maltophlia* were susceptible to levofloxacin but resistant to TMP-SMZ. However, studies have reported increased TMP-SMZ and fluoroquinolone resistances. For example, from 2008 to 2018, 41 clinical *S. maltophilia* isolates were collected through the SENTRY Antimicrobial Surveillance Program and looked for antimicrobial susceptibility. TMP-SMZ sensitivity was 36.6%, and levofloxacin sensitivity was 29.3% (16).

Medical staff were re-educated about blood culture collection procedure. Education of medical staff is important, to prevent using unneccessary antibiotic therapies. After this education no further isolates of *S. maltophilia* have been encountered with blood culture to date.

The limitation of the study is that *S. maltophilia* grown in blood culture and citrated coagulation tube cannot be shown to be the same clone. Pulse field electrophoresis could not be performed during the this period.

## Conclusion

Pseudobacteraemia of *S. maltophilia* was detected in our hospital due to nonsterile blood culture drawing. We would like to emphasize the role of methods for blood culture collection in pseudobacteraemia and the importance of surveillance procedures and educating the hospital staff.

**Ethics Committe Approval:** ??

**Informed Consent:** Patient consent was obtained.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - EÇ, Eİ, TE; Design - TE, AY, TTK; Supervision - TE, EÇ, HÖ; Resource - HÖ, ADA, Eİ; Data Collection and/or Processing - TE, AY, TTK; Analysis and/or Interpretation - HÖ, AY, TTK, ADA; Literature Search - Eİ, EÇ, TE; Writing - HÖ, TE, Eİ, EÇ; Critical Review - Eİ, EÇ, ADA.

**Conflict of Interest:** No financial or non-financial benefits have been received or will be received from any party related directly or indirectly to the subject of this article.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## References

1. *Çiftçi E, Güriz H, Aysev A, Kendirli T, İnce E, Atasay B, et al. Alcaligenes xylosoxidans subspecies denitrificans pseudobacteremia in a university children's hospital. J Hosp Infect 2002;52(1):73-4. https://doi.org/10.1053/jhin.2002.1266*
2. *McNeil MM, Davis BJ, Anderson RL, Martone WJ, Solomon SL. Mechanism of cross contamination of blood culture bottles in outbreaks of pseudobacteremia associated with nonsterile blood collection tubes. J Clin Microbiol 1985;22(1):23-5. https://doi.org/10.1128/jcm.22.1.23-25.1985*
3. *Jumaa PA, Chattopadhyay B. Pseudobacteraemia. J Hosp Infect 1994;27(3):167-77. https://doi.org/10.1016/0195-6701(94)90124-4*
4. *Park YS, Kim SY, Park SY, Kang JH, Lee HS, Seo YH, et al. Pseudooutbreak of Stenotrophomonas maltophilia bacteremia in a general ward. Am J Infect Control 2008;36(1):29-32. https://doi.org/10.1016/j.ajic.2006.12.013*
5. *Klausner JD, Zukerman C, Limaye AP, Corey L. Outbreak of Stenotrophomonas maltophilia bacteremia among patients undergoing bone marrow transplantation: Association with faulty replacement of handwashing soap. Infect Control Hosp Epidemiol 1999;20(11):756-8. https://doi.org/10.1086/501578*
6. *Guyot A, Turton JF, Garner D. Outbreak of Stenotrophomonas maltophilia on an intensive care unit. J Hosp Infect 2013;85(4):303-7. https://doi.org/10.1016/j.jhin.2013.09.007*
7. *Pathmanathan A, Waterer GW. Significance of positive Stenotrophomonas maltophilia culture in acute respiratory tract infection. Eur Respir J 2005;25(5):911-4. https://doi.org/10.1183/09031936.05.00096704*
8. *European Committee on Antimicrobial Susceptibility Testing (EUCAST). Expert rules in antimicrobial susceptibility testing. Available from: https://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Expert_Rules/2020/ExpertRules_V3.2_20190515_Enterobacterales.pdf (Accessed date: 05.2020).*
9. *European Committee on Antimicrobial Susceptibility Testing (EUCAST). Breakpoint tables for interpretation of MICs and zone diameter. Available at: https://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Disk_criteria/Validation_2020/Enterobacterales_v_8.0_January_2020. www.eucast.org/clinical_breakpoints.*
10. *Clinical and Laboratory Standard Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing. CLSI supplement M100. Wayne, PA: CLSI, 2019.*
11. *Alsuhaibani M, Aljarbou A, Althawadi S, Alsweed A, Al-Hajjar S. Stenotrophomonas maltophilia bacteremia in children: Risk factors and mortality rate. Antimicrob Resist Infect Control 2021;10(1):19. https://doi.org/10.1186/s13756-021-00888-w*
12. *Siebor E, Llanes C, Lafon I, Ogier-Desserrey A, Duez JM, Pechinot A, et al. Presumed pseudobacteremia outbreak resulting from contamination of proportional disinfectant dispenser. Eur J Clin Microbiol Infect Dis 2007;26(3):195-8. https://doi.org/10.1007/s10096-007-0260-1*
13. *Clara L, Staneloni MI, Salazar E, Greco G, Visus M, Lizzi A, et al. Report of two events of nosocomial outbreak and pseudo-outbreak due to contamination with Achromobacter spp. Rev Argent Microbiol 2022;54(3):175-80. https://doi.org/10.1016/j.ram.2021.10.004*
14. *Cetre JC, Baratin D, Tissot Guerraz F, Nicolle MC, Reverdy E, Parvaz P, et al. Septicémies nosocomiales et pseudo-bactériémies à Serratia marcescens (Nosocomial septicemia and pseudobacteremia caused by Serratia marcescens). Presse Med 1988;17(24):1255-8.*
15. *Simor AE, Ricci J, Lau A, Bannatyne RM, Ford-Jones L. Pseudobacteremia due to Pseudomonas fluorescens. Pediatr Infect Dis 1985;4(5):508-12. https://doi.org/10.1097/00006454-198509000-00014*
16. *Biagi M, Tan X, Wu T, Jurkovic M, Vialichka A, Meyer K, et al. Activity of potential alternative treatment agents for Stenotrophomonas maltophilia isolates nonsusceptible to levofloxacin and/or trimethoprim-sulfamethoxazole. J Clin Microbiol 2020;58(2):e01603-19. https://doi.org/10.1128/JCM.01603-19*