An Outbreak of *Pseudomonas stutzeri* Bacterial Isolation Caused by Sterile Dressing Products

Min Choi¹, Ji Seon Cheon¹, Woo Young Choi¹, Kyung Min Son¹, Jung Suk Ki², Yeon Kim³

¹Department of Plastic and Reconstructive Surgery, Chosun University College of Medicine, Gwangju;

²Department of Nursing, Chosun University Hospital, Gwangju;

³Department of Quality Improvement, Chosun University Hospital, Gwangju, Korea

Abstract

Wound dressing aids the recovery of infected or postoperative wounds; however, dressings should be administered using appropriate sterilization methods. Occasionally, soft tissue infections, a common type of healthcare-associated infections (HAIs), occur because of specific bacterial isolations that are often attributed to cross-contamination by medical professionals. Here, we report the case of a sudden increase in the incidence of *Pseudomonas stutzeri* isolation from the wounds of nine patients in the plastic surgery department of our hospital. Samples for bacterial cultures were obtained from various areas in the dressing environment to identify the exact cause. *P. stutzeri* was isolated from the saline-soaked cotton container. Therefore, the authors eliminated the use of the dressing container and implemented a dressing procedure that administered saline solution on an individual, need-by-need basis. This new method reduced the incidence of *P. stutzeri*. Additionally, *P. stutzeri* was not isolated from the dressing cart or doctor's gown, suggesting that proper sterilization and careful control of the healthcare setting, personnel, and materials can reduce the transmission and incidence of HAIs.

Keywords: *Pseudomonas stutzeri*, Healthcare-associated infections, Wound infection

Introduction

Healthcare-associated infections (HAIs) occur in patient care settings, especially in hospital environments. With the rapid increase and widespread proliferation of multidrug-resistant (MDR) bacteria, the control and prevention of HAIs remains a challenging health problem. HAIs are caused by viral, fungal, and bacterial pathogens, such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Pseudomonas stutzeri*. *P. stutzeri* is a nonfluorescent denitrifying bacterium that is widely distributed among diverse ecological niches; however, it has been isolated as an opportunistic human pathogen.¹ We witnessed an increase in the incidence of *P. stutzeri* isolations from patient wounds across several wards in our medical center. Here, we discuss our observations and share recommendations for the avoidance of increased *P. stutzeri* incidence in hospital settings.

Case

In the plastic surgery department of our hospital, patients with soft tissue defects are treated with a daily disinfectant regimen, and a bi-weekly wound swab culture is

Case Report

Received: May 15, 2017
Revised: May 25, 2017
Accepted: May 29, 2017

Corresponding author:

Ji Seon Cheon, M.D., Ph.D.

Department of Plastic and Reconstructive Surgery, Chosun University College of Medicine, 309 Pimun-daero, Dong-gu, Gwangju 61452, Korea
Tel: +82-62-220-3180
Fax +82-62-225-0996
E-mail: ps9107@naver.com

No potential conflict of interest relevant to this article was reported.

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performed. After May 2016, the incidence of *P. stutzeri* isolations rapidly increased in patients with soft tissue defects of various body parts. *P. stutzeri* was isolated from nine patients across three wards. Patient characteristics are presented in Table 1. The majority of the patients' wounds were caused by burns or traumas, with two cases occurring because of post-operative soft tissue defects. All patients underwent wound sterilization treatment performed by a single plastic surgeon in the plastic surgery facility. When an increase in wounds contaminated by *P. stutzeri* was observed, the authors consulted the Infection Control Department of the hospital. The department hypothesized that the environment, disinfectant method, and medical staff within the plastic surgery facility could be the source of infection. Therefore, an investigation was conducted. The infection control department produced

cultures using samples obtained from the wound dressing room environment, dressing products, and the doctor's hands and gowns. Sterile cotton swabs containing the samples were streaked across a third of a blood agar plate. We found that *P. stutzeri* was isolated from the saline-soaked cotton dressing container and different strains were isolated from the dressing cart and doctor's gowns (Table 2).

Therefore, since *P. stutzeri* was isolated from the saline-soaked cotton container, the disinfectant was believed to be the cause of the outbreak. After removing the contaminated container, we implemented a procedure to prepare fresh saline-soaked cotton each time a wound dressing was required.

Table 1. Characteristics of nine hospital patients with wound cultures positive for *P. stutzeri*

	Age/Sex	Causes of wound	Locations
1	21/F	Trauma	Ankle
2	59/M	Diabetes mellitus	Foot
3	12/M	Trauma	Knee
4	79/F	Burn	Ankle
5	45/M	Trauma	Thigh
6	60/M	Burn	Shin
7	68/F	Postoperative	Scalp
8	59/M	Diabetes mellitus	Foot
9	69/F	Postoperative	Scalp

Table 2. Results of bacterial cultures from the dressing procedure

	Contents	Results
Dressing environment and products	Normal saline dressing container	<i>Pseudomonas stutzeri</i> (Few)
	Potadine dressing container	No growth
	Dressing forceps	No growth
	Dressing carts	Gram positive bacilli (Few)
	Dressing beds	Gram positive bacilli (Few)
Healthcare team	Doctor's gowns	<i>Staphylococcus aureus</i> (three colonies)
	Doctor's hands	Coagulase-negative <i>staphylococcus</i> (Few)

Figure 1. Monthly occurrence of patients with *P. stutzeri* isolation.

As a result, the incidence of *P. stutzeri* isolations decreased over the next two months (Figure 1).

Discussion

HAIs, also known as nosocomial infections, refer to infections that occur 48 hours after admission to medical institutions such as hospitals, nursing hospitals, and outpatient clinics.² HAIs do not include infections in the incubation period at the time of admission. Each year, millions of patients worldwide are affected by HAIs. Recently, incidences have been attributed to an increase in immunocompromised patients and the generalization of invasive procedures, both of which often lead to extended periods of hospitalization, thereby increasing the mortality risk and medical expenses. Furthermore, a high incidence of infections are caused by MDR bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Staphylococcus aureus*, and vancomycin-resistant *enterococci*.³ HAIs are commonly caused by MRSA, *Acinetobacter baumannii*, and *Pseudomonas aeruginosa*, which can lead to urinary tract infections, postoperative surgical site infections, pneumonia, and soft tissue infections.⁴ Less commonly, HAIs have been shown to be caused by *P. stutzeri*, an anaerobic, nonfermenting, active, gram-negative, oxidase-positive bacteria. *P. stutzeri* rarely induces community-acquired and nosocomial infections, yet HAIs caused by *P. stutzeri* involve pneumonia, meningitis, osteomyelitis, prosthetic knee infections, and soft tissue infections. In addition, *P. stutzeri* can lead to severe bacteremia in immunocompromised patients.⁵ Therefore, epidemiologic studies are needed to improve monitoring and control of HAIs.

In this case report, the authors witnessed a sudden increase in the number of patients with *P. stutzeri* isolations despite application of the medical institution's standard sterilization protocol. Nine patients had *P. stutzeri*-infected wounds, with five wounds caused by burns or trauma, two wounds caused by diabetes mellitus, and two wounds caused by postoperative soft tissue defects. For each case, cultures were obtained from the wound dressing room environment and products, including the saline-soaked cotton container, the potadine-soaked cotton container, dressing forceps, dressing carts, and dressing beds, and from the healthcare team, including the doctor's hands and gowns. Results indicated that the strain of *P. stutzeri* originated exclusively from the saline-soaked cotton container. In addition, Gram-positive bacilli were found on the dressing cart and bed, and three

colonies of *Staphylococcus aureus* and coagulase-negative staphylococci were detected on the doctor's gown and hands, respectively. Therefore, the observed HAIs were caused by cross-contamination of sterile sites. These findings are supported by the reduction of *P. stutzeri* isolations once the contaminated container was removed and a procedure of preparing fresh dressings as needed was implemented. Our findings lend support to the new strategy implemented to reduce the incidence of HAIs.

In the intensive care unit, 40–60% of HAIs are caused by normal flora infections while 20–40% are caused by cross-infections from medical personnel.⁶ The probability of nosocomial infections has decreased with the application of alcohol-based hand sanitizers and propagation of hand hygiene education.⁷ However, despite wearing personal protective equipment, such as gowns and masks, and practising appropriate hand hygiene, doctors remain a primary conduit of HAIs because they are in frequent contact with patients and hospital environments.⁸ This notion is supported by the findings of this case report because bacterial isolations were found on the physician's gown and dressing cart. Therefore, medical institutions should consider infection control strategies to improve sanitization methods and environments.

However, this case report also revealed bacterial isolations in the dressing product, demonstrating the importance of appropriate wound care. Topical antiseptics, such as povidone-iodine, chlorhexidine, alcohol, acetate, hydrogen peroxide, boric acid, and silver nitrate are used in clinical practice.⁹ Normal saline has been used typically for wet dressings because it is cheap and easy to apply, even though the solution has no antiseptic properties.¹⁰ In this case, *P. stutzeri* was isolated from the saline-soaked cotton container, even though the solution and dressing were replaced and freshly prepared daily. However, because saline does not disinfect, harmful bacteria can multiply and be transmitted to other patients. Therefore, the authors eliminated the use of the dressing container and implemented a dressing procedure that administered saline solution on an individual, need-by-need basis. This new method eradicated the observed bacterial isolations.

Although bacteria of the same species were detected in the saline-soaked cotton container, a limitation of the present study might be that a single doctor performed the sterilization wound dressings in our case. This factor is significant because the bacterial contamination could have been a product of individual actions rather than institutional procedures.

Conclusion

HAIs affect millions of patients worldwide, yet they can be controlled with effective strategies and methods. As demonstrated in this case report, proper sterilization and careful control of healthcare settings, personnel, and materials can reduce the transmission and incidence of HAIs.

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