Antimicrobial Resistance and Wound Care

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The discovery of antibiotics has been associated with extending the human lifespan by 23 years[1]; it began in the 1900s and peaked in the 1950s, known as the "golden era" of antibiotics due to the rapid release of new antibiotic classes. However, the gradual increase in antimicrobial resistance and associated infectious disease morbidity and mortality threatens to return the world to a post-antibiotic state where routine surgeries and minor infections become life-threatening again. The O'Neill report, commissioned by the UK Prime minister in 2014 and released in 2016, predicted that without urgent action, antibiotic-resistant infection mortality would reach 10 million people per year by 2050.[2] The 2019 Centers for Disease Control and Prevention Antibiotic Resistance Threat Report found that over 2.8 million antibiotic-resistant infections occur in the United States each year, and more than 35,000 people die from these infections.[3] This is especially concerning given the dearth of new antibiotics being released, and it indicates a clear need for systematic, targeted measures to promote the optimal use of antimicrobial agents.

In wound care, as in other outpatient settings, antimicrobial stewardship aims to maximize clinical outcomes while minimizing the adverse outcomes of their use, including side effects, antimicrobial resistance, toxicity, and selection of pathogenic organisms.[4] The majority of human antimicrobial use occurs in the outpatient setting, with over 260 million prescriptions annually.[5] Most of those antibiotic courses are longer than recommended,[6] including those prescribed for skin and soft tissue infections. This contributes to over 50 million excessive days of therapy per year[6,7] and makes the outpatient wound clinic a key environment for active implementation of antimicrobial stewardship.

How can wound care clinicians help?

Educate yourself on diagnosing and treating organisms and follow proper prescribing recommendations. When using topical antibiotic ointments, know why to use them and what organisms to target. The use of topical antibiotic ointments can increase the amount of gram-negative bacteria in the wound bed[8] and have been associated with allergic reactions that can cross over to oral and intravenous antibiotics in the same class.[9-11] Some topical antibiotic creams are associated with increased rates of infection.[12-14] If using a topical antibiotic ointment to maintain a moist environment, consider an antimicrobial hydrogel or non-antibiotic ointment.

Be an expert clinician, and maximize your clinical exam to improve diagnostic accuracy. Identifying conditions that mimic cellulitis and wound infection (like venous stasis dermatitis, deep vein thrombosis, pyoderma gangrenosum, and vasculitis) can decrease total antibiotic usage.

Take the time to talk to patients about why antibiotics may or may not be necessary and what factors to look out for with the patient and their wound that could change that decision. Patients do not necessarily expect antibiotics. One study found that 54% of prescribers thought patients expected an antibiotic prescription, but only 26% of patients did.[15]

Adhering to good principles of wound management can decrease the need for antibiotics and antifungals. Wound cleansing products and dressings come with a host of antimicrobial options. Antimicrobials have a broader spectrum of activity than topical antibiotics. Some commercially available

options can also be cytotoxic.[16] For many antimicrobial products, the evidence for clinically meaningful cytotoxicity is not clear, but there are plenty of other products for you to safely choose from. Antimicrobials are an important intervention to kill, inhibit, or reduce the number of bacteria within a wound and decrease the need for topical, oral, and intravenous antibiotics.

Antimicrobial stewardship can be assisted through the use of technology and telemedicine. With the multitude of methods available to reach patients, clinicians should feel increased comfort in following up with patients regarding delaying or extending antibiotic courses based on necessity. This has the potential to reduce the number of antibiotic days prescribed substantially. Innovative point-of-care technology can also help differentiate between some microbial species at the bedside to guide antibiotic coverage, debridement, and culturing techniques.

Antimicrobial stewardship at the systems level can involve projects to identify high-priority conditions where antibiotic usage is not optimally prescribed by tracking and reporting clinician antimicrobial prescribing. This can be prescribing unnecessarily, too little, or not prescribing the correct antibiotic. In addition, examining the issues to identify barriers that prevent providers from adhering to best practices would be beneficial. Providing individualized feedback to high prescribers of antibiotics and comparing their prescribing practices to their peers is effective.[17]

While hope remains for new antibiotics through research in under-explored environments and genome mining,[1] clinicians must be continually mindful of their role in antimicrobial resistance and commit to responsible prescribing practices.

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References

1. Hutchings MI, Truman AW, Wilkinson B. Antibiotics: past, present and future. *Curr Opin Microbiol*. 2019;51:72-80. doi:10.1016/j.mib.2019.10.008
2. O'Neill J. *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations*. United Kingdom: Review on Antimicrobial Resistance; 2016.
3. Biggest threats and data. Centers for Disease Control and Prevention. https://www.cdc.gov/drugresistance/biggest-threats.html. Published March 2, 2021.
4. Society for Healthcare Epidemiology of America; Infectious Diseases Society of America; Pediatric Infectious Diseases Society. Policy statement on antimicrobial stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS). *Infect Control Hosp Epidemiol*. 2012;33(4):322-327. doi:10.1086/665010
5. Hicks LA, Bartoces MG, Roberts RM, et al. US outpatient antibiotic prescribing variation according to geography, patient population, and provider specialty in 2011. *Clin Infect Dis*. 2015;60(9):1308-1316. doi:10.1093/cid/civ076
6. Holubar M, Deresinski S. Antimicrobial stewardship in outpatient settings. Uptodate. https://www.uptodate.com/contents/antimicrobial-stewardship-in-outpatient-settings?search=antimicrobial+stewardship&source=search_result&selectedTitle=2~42&usage_type=default&display_rank=2.

7. King LM, Hersh AL, Hicks LA, Fleming-Dutra KE. Duration of outpatient antibiotic therapy for common outpatient infections, 2017. *Clin Infect Dis*. 2021;72(10):e663-e666. doi:10.1093/cid/ciaa1404
8. Bryant RA, Nix DP. *Acute & Chronic Wounds: Current Management Concepts*. 4th ed. Elsevier/Mosby; 2012.
9. Delves, PJ, Roitt, IM. Encyclopedia of immunology. Academic Press; 1998.
10. Sasseville D. Neomycin. *Dermatitis*. 2010;21(1):3-7.
11. Neomycin Sulfate. Contact Dermatitis Institute. Accessed September 1, 2021. https://www.contactdermatitisinstitute.com/neomycin-sulphate.php
12. Barajas-Nava LA, López-Alcalde J, Roqué i Figuls M, Solà I, Bonfill Cosp X. Antibiotic prophylaxis for preventing burn wound infection. *Cochrane Database Syst Rev*. 2013;(6):CD008738. doi:10.1002/14651858.CD008738.pub2
13. Nímia HH, Carvalho VF, Isaac C, Souza FÁ, Gemperli R, Paggiaro AO. Comparative study of Silver Sulfadiazine with other materials for healing and infection prevention in burns: a systematic review and meta-analysis. *Burns*. 2019;45(2):282-292. doi:10.1016/j.burns.2018.05.014
14. Nešporová K, Pavlík V, Šafránková B, et al. Effects of wound dressings containing silver on skin and immune cells [published correction appears in *Sci Rep*. 2021;11(1):4369]. *Sci Rep*. 2020;10(1):15216. doi:10.1038/s41598-020-72249-3
15. Francois Watkins LK, Sanchez GV, Albert AP, Roberts RM, Hicks LA. Knowledge and attitudes regarding antibiotic use among adult consumers, adult Hispanic consumers, and health care providers--United States, 2012-2013. *MMWR Morb Mortal Wkly Rep*. 2015;64(28):767-770. doi:10.15585/mmwr.mm6428a5
16. Punjataewakupt A, Napavichayanun S, Aramwit P. The downside of antimicrobial agents for wound healing. *Eur J Clin Microbiol Infect Dis*. 2019;38(1):39-54. doi:10.1007/s10096-018-3393-5
17. Hallsworth M, Chadborn T, Sallis A, et al. Provision of social norm feedback to high prescribers of antibiotics in general practice: a pragmatic national randomised controlled trial. *Lancet*. 2016;387(10029):1743-1752. doi:10.1016/S0140-6736(16)00215-4