Cost-Effective Solutions to Prevent Orthopedic Infections

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The unprecedented rising cost of healthcare in the United States has been at the forefront of national debate for the past decade and represents a serious threat to the infrastructure of our society. Healthcare costs are currently following an unsustainable growth rate and are projected to constitute 34% of the US gross domestic product by 2040. Commercial and government payers have become increasingly interested in improved resource utilization through regulation, price fixing, and assigning value levels to physician care as a means of cutting costs and improving quality of care. A key component of transitioning from a volume-driven to a value-driven model is individual surgeon accountability to make use of effective, inexpensive solutions supported by cost-effectiveness data. Groups such as the Social and Economic Value of Orthopaedic Surgery Project Team, lead by current AAOS president Dr. John R. Tongue, represent a modern, proactive approach by surgeons to take personal responsibility for reducing healthcare spending. However, while we often think of technological innovation as the primary means to provide improved healthcare solutions, these answers are often expensive and impractical when applied large-scale. Recent findings in the field of perioperative infections show us that we cannot forget to look at past discoveries in other medical disciplines that may offer cost-effective adaptations in orthopedic surgery.[1-3]

Perioperative infections after orthopedic procedures can be devastating complications for patients, families, and physicians alike, with an enormous cost to the healthcare system. The morbidity from surgical site infections includes pain, loss of function, increased hospitalization, prolonged rehabilitation, and higher rates of reoperation.[4] Research has shown that certain orthopedic operations have a significantly greater risk of infection such as revision total knee arthroplasty, ankle fusion, and subtalar fusion.[5] Specialty areas, such as foot and ankle surgery in particular, have been shown to have higher infection rates, compared with other procedures.[6] The resource allocation and financial costs of treating perioperative infections in orthopedic surgery can often rise 3-13 times more than the cost of the index procedure, thus making perioperative infections an ideal target for cost-effective solutions in a value-driven healthcare model.[7,8] There is a tremendous need for effective, low-cost, safe, and easy to use methods of preventing perioperative infections after orthopedic procedures, and dilute Betadine lavage is an example of such a solution.

Povidone-iodine is a stable chemical complex of polyvinylpyrrolidone and elemental iodine (9-12%) that was first sold in 1955 and is now one of the most widely used antiseptics for skin, mucous membranes, and wounds. Betadine is a brand name for a range of povidone-iodine topical antiseptics and has been shown to have bactericidal activity against multiple pathogens, including methicillin-resistant *Staphlococcus aureus*.[9] It is cheap ($1), safe, fast, widely used, and easy to alter into various concentrations. The earliest study by Sindelar and Mason[10] investigating the potential decreases in perioperative infection rates with dilute povidone-iodine irrigation in general and urologic surgery date back as early as 1977. Since then, there have been 14 studies conducted in multiple countries, involving the fields of general, cardiovascular, and urologic surgery. Many of these studies showed similar decreases in infection rates before the idea of using a dilute Betadine lavage was implemented in orthopedic surgery 3 decades later.[11]

In 2005, Cheng and colleagues[12] prospectively studied the effect of a dilute 3.5% Betadine 3-minute lavage on the incidence of postoperative spine infections. They found a significant decrease in infection rate, compared with saline lavage alone,

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without adverse effects on clinical outcomes. Recently, a research group led by Dr. Craig Della Valle[13] demonstrated that a 0.35% Betadine lavage for 3 minutes significantly lowered the rate of acute postoperative infection after total hip and knee arthroplasty from 0.97% to 0.15% in a group of 2550 patients.

Using inexpensive tools that currently exist and applying them in new and innovative ways, represents an area of orthopedic research that should be further pursued and that may provide the cost-effective solutions that the current healthcare environment demands. Parvizi[2] recently showed that levels of synovial C-reactive protein (CRP) could help differentiate between infected and uninfected revision total knee arthroplasties with a sensitivity of 70% and specificity of 100%. CRP is a relatively inexpensive ($15), widely used laboratory test that has been known to rise in response to acute inflammation since its discovery in 1930 by Tillett and Francis.[14] The use of serum CRP has changed the management of orthopedic perioperative infections, and specifically, the diagnosis algorithm for periprosthetic joint infections.[13] CRP represents another example of how using old tools in new ways can address both orthopedic and resource management needs. The use of intrawound vancomycin powder ($12) to decrease postsurgical wound infection in instrumented thoracolumbar fusions may also represent a cost-effective method of infection prevention that is applicable to other orthopedic specialties and should be explored further.[3]

The price of innovation does not need to be high and with the current economic environment and rising costs of healthcare, it is doubtful that expensive solutions to common orthopedic problems will be feasible or sustainable when increased in scale. We need to focus more attention on how to improve our resourcefulness and collaboration with other medical disciplines to foster creative and innovative low-cost solutions to challenging problems. The examples discussed here of dilute Betadine lavage, CRP assays, and vancomycin powder are recent and relevant examples in the orthopedic literature that show that these solutions can and do exist. Furthermore, these existing technologies warrant further research across additional orthopedic specialties to improve the quality of patient care without the additional cost.

Translational research has become a cornerstone of modern medicine and is often described as the synthesis of basic and applied research in order to take basic science advancements and turn them into clinical treatments in a "bench-to-bedside" model. What we should not forget is that translation can take many forms and that discovering new applications to existing technologies may represent a form of translational research in orthopedics that can improve our field within the framework of healthcare reform. Future solutions may exist by looking at the past, but only if we keep our eyes open for them.

Author's Disclosure Statement

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