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Reusable Blood Pressure Cuff-A Real Infectious Danger during Surgery. Is it Time for Disposable Blood Pressure Cuff?

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Abstract

Blood pressure (BP) cuffs are potential vectors for transmission of multi resistant organisms (MROs). High bacterial colonisation rates were detected in BP cuffs from all three areas. BP cuffs from OT were significantly less colonised compared with cuffs from HDU and ED; 76% versus 96% and 100% (P<0.0001) for inner surfaces and 86% versus 98% and 100% (P<0.0001) for outer surfaces. The MRSA level on the inner side (the surface in contact with patients' skin) of blood pressure cuffs used in the wards and outpatient clinics of a university hospital (733 beds) was determined using the gauze and swab wiping methods. Using the gauze wiping method (n=35), the MRSA contamination rate was 31.4%, and the MRSA contamination level was 1,702.6 ± 9,996.1 (0-58, 320) colony-forming units (cfu)/cuff.

Is it time for Disposable blood pressure cuffs?

Disposable blood pressure cuffs are not different than Disposable needles or Disposable endotracheal tubes. Time has come.

Keywords: Blood pressure cuff; Disposable blood pressure cuff; Nosocomial infections; MRSA.

Infection with a Blood Pressure Cuff

Nosocomial infections acquired in a special care nursery were surveyed longitudinally. The rates of acquired infection were determined, allowing the evaluation of specific infection control measures. A blood pressure cuff, utilized for all infants in the nursery, was associated with an increased rate of infection [1].

An empty 500-ml infusion bag was used as the cuff for a Lifestat 100 oscillotonometer. The systolic and mean blood pressures obtained in 40 subjects were not significantly different from those measured with a standard cuff. The diastolic pressure was unrelated between the two cuffs. The empty bag is a cheap and hygienic option in patients who present a high infection risk [2].

We evaluated the potential pathogenic hazard of sphygmomanometer blood pressure cuffs (BPCs) in a hospital setting. Prospectively, the presence of bacterial organisms on 120 BPCs in 14 medical wards and outpatient clinics in a district general hospital in London was assessed. Swabs taken from the inner aspect of the cuffs were cultured using standard microbiological techniques. Bacterial organisms were found in 85% (102) of the 120 BPCs assessed. The highest rates of contamination were found in the outpatients department (90%). There were differences in the most common bacterial species isolated between the samples obtained from the outpatient clinics and the wards, with coagulase-negative Staphylococcus and diphtheroids being the most prevalent species in the wards and outpatient clinics, respectively. These findings

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highlight the necessity to eliminate this potential risk of infection [3].

We investigated the potential role of blood pressure (BP) cuffs in the spread of bacterial infections in hospitals. A comprehensive, prospective study quantitatively and qualitatively evaluating the bacterial contamination on BP cuffs of 203 sphygmomanometers in use in 18 hospital units from January through March 2003.

A university hospital with surgical, medical, and pediatric units. A level of contamination reaching 100 or more colony-forming units per 25 cm was observed on 92 (45%) of inner sides and 46 (23%) of outer sides of 203 cuffs [2]. The highest rates of contamination occurred on the inner side of BP cuffs kept in intensive care units (ICUs) (20 [83%] of 24) or on nurses' trolleys (27 [77%] of 35). None of the 18 BP cuffs presumed to be clean (i.e. those that had not been used since the last decontamination procedure) had a high level of contamination. Potentially pathogenic microorganisms were isolated from 27 (13%) of the 203 BP cuffs: 20 of these microorganisms were Staphylococcus aureus, including 9 methicillin-resistant strains. The highest rates of contamination with potentially pathogenic microorganisms were observed on cuffs used in ICUs and those kept on nurses' trolleys. For 4 patients with a personal sphygmomanometer, a genetic link was found between the strains isolated from the BP cuffs and the strains isolated from the patients.

The results of this survey highlight the importance of recognizing BP cuffs as potential vectors of pathogenic bacteria among patients and as a source of reinfection when dedicated to a single patient, emphasizing the urgent need for validated procedures for their use and maintenance [4].

In the hurried milieu of operating rooms, emergency departments, and intensive care units, contaminated sphygmomanometers (blood pressure cuffs) may not be routinely sanitized or replaced with clean cuffs between patient use. Previous investigations, though few in number, have identified blood pressure cuffs as potential sources of nosocomial infection or vehicles for transmission of contagion in selected patient populations. In this study, presumed "clean" blood pressure cuffs were cultured and evaluated for organismal proliferation and contamination by organic and inorganic debris. Results indicated that frequent bacterial colonization and soiling with organic and inorganic substances did occur on "clean" blood pressure cuffs. Although risk of disease transmission was not measured, the need for better sanitation and disinfection of the cuffs between patient use became evident [5].

Healthcare-associated infection (HAI) is a major but often neglected public health problem. Most attention to HAI prevention is given to high-risk invasive diagnostic and therapeutic healthcare tools, while the importance of less critical tools tends to be underestimated. This study was designed to assess the potential contributory role played by thermometers and blood pressure cuffs in HAI transmission in a Nigerian teaching hospital. Analysis of swabs from thermometers and blood pressure cuffs used in the teaching hospital was conducted using standard microbiological techniques.

Results showed that 62.1% of thermometers and 82.1% of blood pressure cuffs examined were contaminated with Staphylococcus aureus, Pseudomonas aeruginosa or Enterococcus faecalis. S. aureus was the most common bacterial isolate, constituting 86.1% and 73.9% of the isolates from thermometers and blood pressure cuffs, respectively. Up to 80% and 100% of thermometers and pressure cuffs from the nursing unit and medical ward were contaminated. The bacterial isolates were resistant to the majority of the antibiotics tested, but all were susceptible to ciprofloxacin and streptomycin to varying degrees. This study emphasizes the urgent need to sanitize thermometers and blood pressure cuffs between patients to minimize transmission of resistant bacteria within hospitals by cross-colonization of non-critical medical devices used by healthcare staff [6].

We investigated a cluster of mupirocin-resistant Staphylococcus aureus on a dermatology ward. An outbreak of mupirocin-resistant S aureus was noted on the dermatology ward during a prospective epidemiologic study of methicillin-resistant S aureus (MRSA) and borderline methicillin-susceptible S aureus (BMSSA). Pulsed-field gel electrophoresis (PFGE) of whole-cell DNA digested with Sma I was used as a marker of strain identity. An 850-bed university hospital with a 12-bed inpatient dermatology ward. Most patients have severe, exfoliating dermatologic disorders.

MRSA or BMSSA were isolated from 13 patients on the dermatology ward over a 14-month period. Eleven of these isolates (84.6%) were mupirocinresistant. Nine isolates were present on admission (81.8%); 8 of these patients had been hospitalized on the same ward within the last two months. Nasal and hand cultures from 36 personnel were negative for mupirocinresistant MRSA or BMSSA. Extensive environmental culturing revealed that a blood pressure cuff and the patients' communal shower were positive for mupirocin-resistant BMSSA. PFGE of all mupirocin-resistant isolates demonstrated that the nine patients and both environmental sources had identical DNA typing patterns.

Changing of blood pressure cuffs between patients and more stringent cleaning of communal areas was initiated. Repeat environmental cultures were negative. S aureus is not usually associated with an environmental reservoir; however, these patients all had severe desquamation, which may have prolonged environmental contamination [7].

This paper reports two unusual instances of ethylene oxide burns that were caused by the blood pressure cuff sterilized with ethylene oxide. It is suggested that the mechanical compression caused by the blood pressure cuff facilitated penetration of ethylene oxide residues into tissues and contributed to the degree of tissue damage [8].

Concerns have been raised over poor standards of hospital cleanliness and insufficient time for staff to clean reusable communal patient care equipment. These items may then act as vectors for the transmission of nosocomial pathogens between hospital patients.

We evaluated the impact of cleaning duration on nosocomial infection rates and estimate the time required to clean care equipment in accordance with national specifications (i.e. a 'time to clean'). A systematic review of the published literature on cleaning times and an observational study in which nine healthcare workers cleaned seven items of care equipment while the duration of time taken to clean each item was measured.

A limited volume of low-quality evidence indicates that increased cleaning times in hospitals can reduce the incidence of healthcare-associated infections (HCAIs). The mean 'time to clean' for care equipment ranged from 166.3 s (95% confidence interval [CI] = 117.8-214.7) for a bed frame to 29.0 s (95% CI = 13.4-44.6) for a blood pressure cuff.

'Time to clean' estimates for care equipment provide an indication of how much protected time is necessary to ensure acceptable standards of cleanliness. Clinical trials are needed to further evaluate the impact of increased cleaning times on nosocomial infection rates [9].

Skin Penetration

Many drugs are presently delivered through the skin from products developed for topical and transdermal applications. Underpinning these technologies are the interactions between the drug, product and skin that define drug penetration, distribution, and elimination in and through the skin. Most work has been focused on modelling transport of drugs through the stratum corneum, the outermost skin layer widely recognized as presenting the rate determining step for the penetration of most compounds. However, a growing body of literature is dedicated to considering the influence of the rest of the skin on drug penetration and distribution. In this article we review how our understanding of skin physiology and the experimentally observed mechanisms of transdermal drug transport inform the current models of drug penetration and distribution in the skin. Our focus is on models that have been developed to describe particular phenomena observed at particular sites of the skin, reflecting the most recent directions of investigation [10].

For an improved understanding of the relevant particle features for cutaneous use, we studied the effect of the surface charge of acrylic nano capsules (around 150nm) and the effect of a chitosan gel vehicle on the particle penetration into normal and stripped human skin *ex vivo* as well as local tolerability (cytotoxicity and irritancy). Rhodamin-tagged nanocapsules penetrated and remained in the stratum corneum. Penetration of cationic nanocapsules exceeded the penetration of anionic nanocapsules. When applied on stripped skin, however, the fluorescence was also recorded in the viable epidermis and dermis. Cationic surface charge and embedding the particles into chitosan gel favored access to deeper skin. Keratinocytes took up the nanocapsules rapidly. Cytotoxicity (viability<80%), following exposure for ≥ 24h, appears to be due to the surfactant polysorbate 80, used for nanocapsuleś stabilization. Uptake by fibroblasts was low and no cytotoxicity was observed. No irritant reactions were detected in the HET-CAM test. In conclusion, the surface charge and chitosan vehicle, as well as the skin barrier integrity, influence the skin penetration of acrylic nanocapsules. Particle localization in the intact stratum corneum of normal skin and good tolerability make the nanocapsules candidates for topical use on the skin, provided that the polymer wall allows the release of the active encapsulated substance [11].

Delivery across skin offers many advantages compared to oral or intravenous routes of drug administration. Skin however is highly impermeable to most molecules on the basis of size, hydrophilicity, lipophilicity and charge. For this reason it is often necessary to temporarily alter the barrier properties of skin for effective administration. This can be done by applying chemical enhancers, which alter the lipid structure of the top layer of skin (the stratum corneum, SC), by applying external forces such as electric currents and ultrasounds, by bypassing the stratum corneum via minimally invasive microneedles or by using nano-delivery vehicles that can cross and deliver their payload to the deeper layers of skin [12].

Liposomes are frequently described as drug delivery systems for dermal and transdermal applications. Recently, it has been shown that particulate substances penetrate effectively into hair follicles and that the follicular penetration depth can be increased by massaging the skin, which simulates the *in vivo* movement of hairs in the hair follicles. In the present study, massage was applied to skin mounted to Franz diffusion cells. By means of confocal laser scanning microscopy, the influence of massage and occlusion on the follicular penetration depths of rigid and flexible liposomes loaded with a hydrophilic and lipophilic dye was investigated. The application of massage increased follicular penetration significantly. Occlusion resulted in an increased follicular penetration depth only for rigid liposomes, whereas invasomes did not penetrate more effectively if occlusion was applied. The results confirm that massage is an important tool for increasing follicular penetration in *ex vivo* studies using Franz diffusion cells. Occlusion may reduce the efficacy of follicular penetration depending on the specific liposomal preparation. Rigidity in particular appears to be a relevant parameter [13].

Skin Microbiome

The influence of the skin microbiota on host susceptibility to infectious agents is largely unexplored. The skin harbors diverse bacterial species that may promote or antagonize the growth of an invading pathogen. We developed a human infection model for Haemophilus ducreyi in which human volunteers are inoculated on the upper arm. After inoculation, papules form and either spontaneously resolve or progress to pustules. To examine the role of the skin microbiota in the outcome of H. ducreyi infection, we analyzed the microbiomes of four dose-matched pairs of "resolvers" and "pustule formers" whose inoculation sites were swabbed at multiple time points. Bacteria present on the skin were identified by amplification and pyrosequencing of 16S rRNA genes. Nonmetric multidimensional scaling (NMDS) using BrayCurtis dissimilarity between the pre infection microbiomes of infected sites showed that sites from the same volunteer clustered together and that pustule

formers segregated from resolvers (P=0.001, permutational multivariate analysis of variance [PERMANOVA]), suggesting that the pre infection microbiomes were associated with outcome. NMDS using Bray-Curtis dissimilarity of the endpoint samples showed that the pustule sites clustered together and were significantly different than the resolved sites (P=0.001, PERMANOVA), suggesting that the microbiomes at the endpoint differed between the two groups. In addition to H. ducreyi, pustule-forming sites had a greater abundance of Proteobacteria, Bacteroidetes, Micrococcus, Corynebacterium, Paracoccus, and Staphylococcus species, whereas resolved sites had higher levels of Actinobacteria and Propionibacterium species. These results suggest that at baseline, resolvers and pustule formers have distinct skin bacterial communities which change in response to infection and the resultant immune response.

Human skin is home to a diverse community of microorganisms, collectively known as the skin microbiome. Some resident bacteria are thought to protect the skin from infection by outcompeting pathogens for resources or by priming the immune system's response to invaders. However, the influence of the skin microbiome on the susceptibility to or protection from infection has not been prospectively evaluated in humans. We characterized the skin microbiome before, during, and after experimental inoculation of the arm with Haemophilus ducreyi in matched volunteers who subsequently resolved the infection or formed abscesses. Our results suggest that the pre-infection microbiomes of pustule formers and resolvers have distinct community structures which change in response to the progression of H. ducreyi infection to abscess formation [14].

A 1-week-old infant was brought to a regional hospital with a history of recurrent seizures following lower abdominal septic skin infection. She was found to have neonatal tetanus, and a spatula test was positive. The tetanus infection was associated with a superficial skin infection, common in neonates. Treatment included sedatives (diazepam, chlorpromazine, phenobarbitone and morphine), muscle relaxants, antibiotics and ventilation in the neonatal intensive care unit. Intrathecal and intramuscular immunoglobulin were given, and the wound was treated. The infant recovered, with no seizures by the 16th day from admission, and was off the ventilator by the 18th day. This was shorter than the usual 3-4 weeks for neonates with tetanus at the hospital. The question arises whether tetanus immunisation should be considered in infants with skin infections, which frequently occur in the neonatal period [15].

The human microbiome has recently gained prominence as a major factor in health and disease. Here we review the literature regarding the microbiome and cancer and suggest how the microbiome may be manipulated for improved health outcomes. The gut microbiome has been relatively well studied, and the mechanisms of how it may increase or decrease the risk of certain cancers may apply to the skin microbiome. Additionally, the gut microbiome may directly impact the risk of cancer in the skin and other organs by promoting systemic inflammation. The skin microbiome itself is as diverse as the gut microbiome, but research has just begun to unravel its influence on the host. Like the gut microbiome, it affects the risk for several diseases, including cancer. By using health promoting strains from the microbiome in oral or topical probiotics, it may be possible to reduce the risk of skin cancer and perhaps even increase the likelihood of successful treatment [16].

An abundant and diverse collection of bacteria, fungi, and viruses inhabits the human skin. These microorganisms vary between individuals and between different sites on the skin. The factors responsible for the unique variability of the skin microbiome are only partly understood, but results suggest that host genetic and environmental influences play a major role. Today, the steady accumulation of data describing the skin microbiome, combined with experiments designed to test the biological functions of surface microbes, has provided new insights into links between human physiology and skin microbiota. This review describes some of the current information regarding the skin microbiome and its impact on human health. Specifically, we summarize the present understanding of the function of microbe-host interactions on the skin and highlight some unique features that distinguish skin commensal organisms from pathogenic microbes [17].

Until recently, human microbiology was based on the identification of single microbes, such as bacteria, fungi and viruses, frequently isolated from patients with acute or chronic infections. Novel culture-independent molecular biochemical analyses (genomics, transcriptomics, proteomics, metabolomics) allow today to detect and classify the diverse microorganisms in a given ecosystem (microbiota), such as the gastrointestinal tract, the skin, the airway system, the urogenital tract and others, and to assess all genomes in these ecosystems (microbiome) as well as their gene products. These analyses revealed that each individual has its own microbiota that plays a role in health and disease. In addition, they greatly contributed to the recent advances in the understanding of the pathogenesis of a wide range of human diseases. It is to be expected that these new insights will translate into diagnostic, therapeutic and preventive measures in the context of personalized/ precision medicine [18].

The skin is colonized by an assemblage of microorganisms which, for the most part, peacefully coexist with their hosts. In some cases, these communities also provide vital functions to cutaneous health through the modulation of host factors. Recent studies have illuminated the role of anatomical skin site, gender, age, and the immune system in shaping the cutaneous ecosystem. Alterations to microbial communities have also been associated with, and likely contribute to, a number of cutaneous disorders. This review focuses on the host factors that shape and maintain skin microbial communities, and the reciprocal role of microbes in modulating skin immunity. A greater understanding of these interactions is critical to elucidating the forces that shape cutaneous populations and their contributions to skin homeostasis. This knowledge can also inform the tendency of perturbations to predispose and/or bring about certain skin disorders [19].

The Cutaneous Microbiome and Wounds

The ecological community of microorganisms in/on humans, termed the microbiome, is vital for sustaining homeostasis. While culture-independent techniques have revealed the role of the gut microbiome in human health and disease, the role of the cutaneous microbiome in wound healing is less defined. Skin commensals are essential in the maintenance of the epithelial barrier function, regulation of the host immune system, and protection from invading pathogenic microorganisms. In this review, we summarize the literature derived from pre-clinical and clinical studies on how changes in the microbiome of various acute and chronic skin wounds impact wound healing tissue regeneration. Furthermore, we review the mechanistic insights garnered from model wound healing systems. Finally, in the face of growing concern about antibiotic-resistance, we discuss alternative strategies for the treatment of infected wounds to improve wound healing and outcomes. Taken together, it has become apparent that commensals, symbionts, and pathogens on human skin have an intimate role in the inflammatory response that highlights several potential strategies to treat infected, non-healing wounds. Despite these promising results, there are some contradictory and controversial findings from existing studies and more research is needed to define the role of the human skin microbiome in acute and chronic wound healing [20].

Chronic, non-healing wounds place an enormous burden on both the health care system and patients, with no definitive treatments available. There has been increasing evidence that the microbial composition of wounds may play an important role in wound healing. Culture-independent methods for bacterial detection and analysis have revealed the wound microbiome to be much more diverse and complex than culture alone. Such methods primarily rely on targeted amplification and sequencing of various hypervariable regions of the bacterial 16S rRNA for phylogenetic analysis. To date, there have been several studies utilizing culture-independent methods to investigate the microbiome of a variety of chronic wounds, including venous insufficiency ulcers, pressure ulcers, and diabetic foot ulcers. Major bacteria found include Staphylococcus, Streptococcus, Corynebacterium, Pseudomonas, and various anaerobes. Current studies suggest that improved healing and outcomes may be correlated with increased bacterial diversity and instability of the microbiome composition of a wound. However, the exact role of the microbiome in wound healing remains poorly understood. While the current research is promising, studies are very heterogeneous, hindering comparisons of findings across different research groups. In addition, more studies are needed to correlate microbiome findings with clinical factors, as well as in the relatively unexplored fields of acute wounds and nonbacterial microbiomes, such as the wound mycobiome and virome. Better understanding of the various aspects of the microorganisms present in wounds may eventually allow for the manipulation of the wound microbiota in such a way as to promote healing, such as through bacteriophage therapies or probiotics [21].

The acquisition and development of the infant microbiome are key to establishing a healthy host-microbiome symbiosis. The maternal microbial reservoir is thought to play a crucial role in this process. However, the source and transmission routes of the infant pioneering microbes are poorly understood. To address this, we longitudinally sampled the microbiome of 25 mother-infant pairs across multiple body sites from birth up to 4 months postpartum. Strain-level metagenomic profiling showed a rapid influx of microbes at birth followed by strong selection during the first few days of life. Maternal skin and vaginal strains colonize only transiently, and the infant continues to acquire microbes from distinct maternal sources after birth.

Maternal gut strains proved more persistent in the infant gut and ecologically better adapted than those acquired from other sources. Together, these data describe the mother-to-infant microbiome transmission routes that are integral in the development of the infant microbiome [22].

The skin supports a delicate ecosystem of microbial elements. Although the skin typically acts as a barrier, these microbes interact with the internal body environment and imbalances from the "healthy" state that have been linked to several dermatologic diseases. Understanding the changes in microbial flora in disease states allows for the potential to treat by restoring equilibrium. With the rising popularity of holistic and natural consumerism, prebiotics, probiotics, symbiotic, and other therapies are under study to find alternative treatments to these skin disorders through manipulation or supplementation of the microbiome [23].

Blood Pressure Measurement of all Five Fingers

The aim of the present paper was to study the methodological problems involved in measuring systolic blood pressure in all five fingers by the strain gauge technique. In 24 normal subjects, blood pressure at the proximal phalanx of finger-I and both at the proximal and the intermediate phalanx of the other fingers was measured using a 24-mm-wide cuff. Blood pressure at the proximal phalanx was higher than that at the intermediate phalanx in all fingers except finger V. The difference of blood pressure values corresponded well with circumference of the finger. In 15 normal subjects, blood pressure at the proximal phalanx was compared in fingers I, III, IV, and V, using 16, 20, 24 and 24 mm wide cuffs. Finger blood pressure was closest to arm systolic blood pressure when a 24-mm or 27-mm-wide cuff was used in fingers I, III, and IV, and with a 20-mm-wide cuff in finger V. By using the 20mm-wide cuff in finger V and the 24-mm-wide cuff in the other fingers, normal value of finger blood pressure was determined for both proximal and intermediate phalanxes [24].

Surgical Site Infection

Surgical site infection (SSI) is a well-known complication of general surgery. Although overall SSI rate is relatively low, it is the most common nosocomial infection. SSI adversely affects patient outcomes and healthcare costs.

Patients who underwent general surgical procedures between 2003 and 2009 were included in the study. SSI

diagnosed based on the National Nosocomial Infection Surveillance System (NNIS) criteria. Patients were classified into two groups: SSI (+) and SSI (-). Patient demographics, comorbidities, procedural details, and SSI type and treatment were evaluated. Multivariate analysis was performed to determine independent risk factors of SSI.

In total, 4690 patients were included. Overall SSI rate was 4.09% (192/ 4690). Colorectal surgery was associated with the highest SSI rate (9.43%) followed by pilonidal sinus (8.79%), upper gastrointestinal (GI) (8.09%), hepatobiliary (6.68%), hernia (0.78%), and breast-thyroid (0.3%) surgery. Procedure type (pilonidal sinus, colorectal, hepatobiliary and upper GI surgery), prolonged preoperative hospital stay, higher ASA score, emergency surgery, dirty- infected wound class, experienced surgeon, prolonged operating time, presence of surgical drains, and intraoperative transfusion were determined as independent risk factors of SSI (p 0.05).

Most of the determined risk factors were surgeon and procedure related. Reduced SSI rate and better outcomes can be achieved by controlling modifiable risk factors [25]. We investigated the incidence of nosocomial infections of extremely premature infants and to explore the risk factors and strategies for infection control.

There were 118 extremely premature infants who were confirmed to have nosocomial infection in neonatal intensive care unit of the authors' hospital from January 2008 to December 2012. Their data of the infection rate, risk factors and clinical characteristics were retrospectively analyzed.

During the study, nosocomial infection occurred in 78 extremely premature infants 129 times. The nosocomial infection rate was 66.10%. The rate of ventilator-associated pneumonia (VAP) was 1.43% (35/2 452). The catheter related blood stream infection (CRBSI) rate was 0.35% (16/4 613). There were 74 (57.36%) cases of pneumonia, which was the most common nosocomial infection of extremely premature infants. There were 35 cases of VAP, which accounted for 47.30% of pneumonia. The next was sepsis, 48 cases. Seventy-four (74/90, 82.22%) strains of isolates were Gram-negative bacteria, which accounted for the highest proportion, followed by Gram positive (12 strains), fungus (4 strains); Klebsiella pneumonia is the most common pathogens of nosocomial infection in extremely premature infants. The isolation rates of Klebsiella pneumonia with positive extended-spectrum beta-lactamases (ESBL) were 90.91% (20/22), universally resistant to cephalosporins. Single-factor analysis showed that the body weight, mechanical ventilation, umbilical vein catheterization, central venous catheter, parenteral nutrition and hospitalization time were risk factors for nosocomial infections in extremely preterm infants. Logistic regression analysis showed that length of hospitalization (OR=1.024, P=0.043) and central venous catheterization (OR=6.170, P=0.041) were independent risk factors of nosocomial infection.

Extremely preterm infants were at higher risk of nosocomial infection. It is important to identify the high risk factors for nosocomial infections in extremely premature infants. To shorten time for mechanical ventilation, central venous catheterization and hospitalization days would be conducive to reducing the morbidity of nosocomial infection [26].

Although much has been written about excess cost and duration of stay (DOS) associated with surgical site infections (SSIs) after cardiothoracic surgery, less has been reported after vascular and general surgery. We used data from the National Surgical Quality Improvement Program (NSQIP) to estimate the total cost and DOS associated with SSIs in patients undergoing general and vascular surgery.

Using standard NSQIP practices, data were collected on patients undergoing general and vascular surgery at a single academic center between 2007 and 2009 and were merged with fully loaded operating costs obtained from the hospital accounting database. Logistic regression was used to determine which patient and preoperative variables influenced the occurrence of SSIs. After adjusting for patient characteristics, costs and DOS were fit to linear regression models to determine the effect of SSIs.

Of the 2,250 general and vascular surgery patients sampled, SSIs were observed in 186 inpatients. Predisposing factors of SSIs were male sex, insulin-dependent diabetes, steroid use, wound classification, and operative time ($P<0.05$). After adjusting for those characteristics, the total excess cost and DOS attributable to SSIs were $10,497 ($P<0.0001$) and 4.3 days ($P<0.0001$), respectively.

SSIs complicating general and vascular surgical procedures share many risk factors with SSIs after cardiothoracic surgery. Although the excess costs and DOS associated with SSIs after general and vascular surgery are somewhat less, they still represent substantial financial and opportunity costs to hospitals and suggest, along with the implications for patient care, a continuing need for cost-effective quality improvement and programs of infection prevention [27].

Although the rate of surgical site infections (SSIs) in total hip and knee arthroplasties is low relative to total number of procedures performed, SSIs can debilitate patients, prolong hospital stays, and dramatically increase health care costs. Constant adherence to anti-SSI measures (preoperative, perioperative, postoperative) benefits everyone. Carefully analysing the major cause of SSIs, conducting risk assessments around each modifiable factor, and implementing robust SSI prevention programs are crucial. The US government recently funded an SSI prevention educational initiative for health care facilities and workers. Project JOINTS (Joining Organization IN Tackling SSIs), a program of the Institute for Healthcare Improvement, was developed to disseminate new information and provide training in SSI prevention. Use of risk assessment and prevention measures, including those recommended by Project JOINTS, should help reduce the incidence of SSIs in total hip and knee arthroplasties [28].

Contamination of Blood Pressure Cuffs by Methicillin-Resistant Staphylococcus Aureus (MRSA)

Although blood pressure cuffs are commonly used and shared in medical facilities, their routine disinfection is

performed infrequently. We investigated the contamination of blood pressure cuffs by methicillin resistant Staphylococcus aureus (MRSA).

The MRSA level on the inner side (the surface in contact with patients' skin) of blood pressure cuffs used in the wards and outpatient clinics of a university hospital (733 beds) was determined using the gauze and swab wiping methods.

Using the gauze wiping method (n=35), the MRSA contamination rate was 31.4%, and the MRSA contamination level was 1,702.6 ± 9,996.1 (0-58, 320) colony-forming units (cfu)/cuff. No MRSA was detected on blood pressure cuffs after washing (n = 30) or wiping with 80 vol% ethanol (n = 18). Blood pressure cuffs are frequently contaminated by MRSA [29].

Blood pressure (BP) cuffs are potential vectors for transmission of multi resistant organisms (MROs). The present study aims to determine MRO colonisation rates in BP cuffs from areas of high patient flow as an assessment of the quality of disinfection and infection control practices.

BP cuffs in the ED, high dependency unit (HDU) and operating theatres (OT) were prospectively examined after routine disinfection procedures. Swabs collected from the inner and outer surfaces of BP cuffs during inter-patient intervals were plated onto replicate organism detection and counting, methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant Enterococcus (VRE) chromogenic agar plates to detect rates of bacterial, MRSA and VRE colonisation, respectively.

High bacterial colonisation rates were detected in BP cuffs from all three areas. BP cuffs from OT were significantly less colonised compared with cuffs from HDU and ED; 76% versus 96% and 100% ($P<0.0001$) for inner surfaces and 86% versus 98% and 100% ($P<0.0001$) for outer surfaces, respectively. Equivalent or higher bacterial growth was observed on the inner surface compared with outer surface in 54%, 84% and 86% of BP cuffs from OT, HDU and ED, respectively. MRSA was detected in 3 of 150 (2%) swabs collected, but no VRE was detected. Although MRSA and VRE were infrequently isolated, current disinfection and infection control protocols need to be improved given the greater recovery of organisms from the inner compared with outer surfaces of BP cuffs [30].

Conclusion

Disposable blood pressure cuffs are not different than Disposable needles or Disposable endotracheal tubes. Time has come.

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