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Infection control measures to reduce nosocomial infection rates in the Medical city burn center

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Abstract:

Background: The most serious problem in burn units is nosocomial infection (NI). In extensive burn patients, sepsis is considered the main cause of death; infection control program will help to lower NI and its subsequent high mortality rate.

Objective: To achieve the lowering of NI in burn units, by effect of infection control measures (ICMs).

Patients and methods: This is a prospective study conducted on patients admitted in Burn Center/Medical City in Baghdad from May 2012 to April 2015. A total of 1977 hospitalized patients were included in this study. This center receives burn patients with different severity. In around April 2012 an infection control program was started in the center by the infection control team ICT.

Results: The rate of NI was reduced; the mortality rates declined, and mean hospital stay of NI patients decreased. The number of cases with burn wound infection (BWI), bacteremia sepsis and subsequent mortality were decreased.

Conclusion: ICMs helped to reduce NIs in the burn center .Rational usage of antibiotic and baths, new dressing, early excision and grafting are vital and recommended.

Keywords: Burn, wound infection, nosocomial infection, infection control measures.

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Introduction:

Burns are still the most well-known and disastrous forms of trauma in the world. Its wounds are easily liable for infection. Infections and its complications are participated by the destruction of the biological barrier with the impairment of systemic and local immune responses. (1) Patients with extensive burns require urgent organized care in specialized burn centers to decrease mortality and morbidity, which lead to improvement of patient's survival rates. (2) The common cause of early burn wound infection is S.aureus. Pseudomonas aeruginosa also represents one of the main causative microorganisms; its source in many centers is usually from the flora of the same patient and the surrounding environment. (3, 4, 5) Fungal infections are another serious cause of death; a fact is vital in treating sepsis in patients with severe burn. The risk for mycoses is even higher than that with cancer or organ transplant. (6) Burn wound infection (BWI) represents is the most common nosocomial infection in burn centers. (7) The area of a burn wound is usually rich with protein-, poor blood supply, and filled with necrotic tissue, so it can be infected easily. Necrotic tissue forms a culture media for the growth of microorganism, the cells responsible for defensive and immunity cannot reach the area due to poor blood supply; resulting in a weak immune response . Microorganisms colonizing the patient's skin and those from hospital environment represent gram positive bacteria which are common in early post-burn period (first 48 hour) .During the first week post burn a gram negative bacteria appears (7, 8, 9),leading to increase NI rates elevated (10, 11).

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Patients and methods:

A prospective was conducted in the 45-bed Burn Center / Medical City in baghdad during a 3 -year period from May 2012 to April 2015 in which 1977 patients were included. The infection control team is composed of 4 doctors (3 general surgeons, 1 plastic surgeon), 2 intensivest doctors, 16 nurses (4 nurses' work with each doctor as a team) four cleaning staff, and another 15 nursing staff persons as alternative. The center is the reference tertiary burn center in Baghdad, so it receives patients with extensive burns from different secondary hospitals, primary care centers, and unofficially herb worker clinics. Excision and cleaning of burn wounds was done in the emergency department under supervision of the emergency specialist doctor. Washing and bathing is done in one of the four baths in the ward done on need. When the IC program was started in April

Table 1 Distribution of patients.

Variable	Category	No. (%)
gender	male	884 (44.7%)
	female	1093 (55.3%)
Age (years)	< 5	297 (15.02%)
	6-14 years	450 (22.8%)
	15-50 years	857 (43.3%)
	> 50	373 (18.9%)
Total		1977 (100%)

2012, diagnoses and observation of NI with regular consultation were carried out by an (ICT). Prior to implementation of the infection control program, the rate of resistant P.aeruginosa strains was high and pan-resistant strains were observed .Environmental surveillance cultures were performed. The surgeons and other ICT act to decrease the rates of NI and resistance of antibiotic. Periodic training of ICT about infection control measures ICMs was done. ICMs simply involves hand washing, isolation and precautions methods, catheter nursing, burn wound infection care, environmental cleaning, asepsis and disinfection methods. Lectures were delivered to IC staff on weekly basis. Discussion of the problems faced and its recommended solutions were practiced. Antiseptic solutions were placed near the doors of all rooms and are used before and after visiting the patients to improve hand hygiene and reinforce disinfection. The burn center contains 22 (single-beds) rooms. Four additional rooms were opened as high dependency unit (HD) for patients with severe colonization and/ or infection; while more critically ill patients were managed separately in the intensive care unit (ICU).Previously it was the routine to give carbapeneams on admission and to be continued for weeks. Upon the implementation of the IC Program empirical antibiotic prescription was discontinued, and treatment was based on the results of cultures and sensitivity, as recommended by the ICT. The results of multiple swaps cultures revealed that word baths and theatre were the most important rout of multidrug/pan- resistant P.aeruginosa microorganisms. This pathogen was isolated repeatedly from drains, taps, and walls of the baths. In fact, proper disinfection did not prevent growth of P. aeruginosa in some regions of the baths, so ICT decided to limit the usage of baths. Previously, only silver sulfadiazine was used for burn wounds, but new dressings like (aquacel, comfeel, acticote, silverlone and hydrogel with alginate) were introduced to cover and treat most burns. Early surgical excision and graft operations (allo- and auto-grafts) in the early period were more frequent. For better follow up and more efficient wound excision experienced residents were employed in the burn center. Instructions were given to patients' relatives about the rules of ICMs, which involve limitation of visits to the patients.

Results:

Over the three year period of the study, 1977 patients were admitted and included in the study. The description of these patients and their burns is shown in tables 1 and 2 respectively. During this period there was a significant decrease in the rate of NI infection.

Table 2 Description of the burns

Variable	Category	No. (%)
Total Body Surface Area	1-20	312 (15.8%)
	21-40	381 (19.3%)
	41-60	544 (27.5%)
	61-80	429 (21.7%)
	81-100	311 (15.7%)
Type of burns	Hot Scald	824 (41.7%)
	Flame Tandoor house fire	615 (31.1%)
	Blast and war burn	493 (24.9%)
	Electric	34 (1.7%)
	Chemical	11(0.6%)
Total		1977 (100%)

There were 441 NI patients (187 BWI, 92 sepsis, 84 surgical site infections, 33 pneumonia, 29 upper respiratory tract infections, and 16 urinary tract infections) diagnosed and studied. The rate of NI was decreased by 23.7% overall. It was 52.3% during the first year, 31.9% during the second year, and 15.6% during the third year. The reduction in the mortality rate was as follow: 21% for the first year, 14% for the second year, and 9% for the third year. The reduction of mean hospital stay was from 53 days to 45 days. Table 3 shows the distribution of NI rates.

Table 3: Distribution of nosocomial infections rates by year

Type of NI	May 2012- Apr 2013	May 2013- Apr 2014	May 2014- Apr 2015	Total
BWI	96 (51.3%)	58(31.0%)	33 (17.6%)	187 (42.4%)
BWI + sepsis	54 (58.7%)	27 (29.3%)	11 (12.0%)	92 (20.8%)
SSI	47 (56.0%)	29 (34.5%)	8 (9.5%)	84(19.0%)
BWI + pneumonia	13 (39.4%)	13 (39.4%)	7 (21.2%)	33 (7.4%)
URI	12 (41.4%)	9 (31.0%)	8 (27.6%)	29 (6.5%)
UTI	9 (56.3%)	6 (37.5%)	1 (6.3%)	16 (3.6%)
Total	231(52.3%)	142 (31.9%)	68 (15.6%)	441(100%)

Discussion:

The diagnosis of imipenem-resistant P. aeruginosa patients represents a risk for transmission of this microorganism in burn center (12). In order to decrease infection rates in burn units these patients should be isolated (13, 14). Cleaning of contaminated ward paths is so difficult, so it remains a place of cross-contamination of bacteria, especially P. aeruginosa between hospitalized patients. Patients referred from other health facilities many days after burn injury and those who have been managed by traditional healers also carry high risk of contamination and subsequent cross-contamination. It has been shown that commitment with ICMs can reduce the NI rates. For example a common route for cross-contamination is the hands of health care

workers. Hand washing is and easy and cheap method to decrease / prevent NI rate. The infection rates were lowered to 36% in an orthopedic surgical word, when alcohol hand rub was used. (15) In addition, the use of surgical gloves, gowns, and slippers is mandatory for burn patients with high-risk to stop or minimize cross contamination of NI. (16) On admission, it was found that 35.3% of the burn is sterile, and that bacterial colonization increased to reach 86.3% in seven days. The most prevalent isolated microorganism in admission cultures was coagulase-negative staphylococci (63.0%) and S. aureus (19.7%). An extreme elevation in S. aureus and P. aeruginosa numbers was detected till day 21. Candida species was isolated from a large number of BWI; Zülal Ozkurt et al study isolates these microorganisms from BWI (17, 18). This usually occurs late after burn injury and may be contributed to the use of broad-spectrum antibiotic for a long time (18). The reported time between the colonization of the burn wound with candida and infections of other sites with candida was day 30 and 41 post-burn, respectively, and is common to affect patient with large surface area burns of more than 50% (18). As there is no role of prophylactic antibiotics in burn patients to reduce BWI, (19) systemic antibiotics have to be prescribed carefully according to culture and sensitivity results, and should be given for a short time (1, 7) to decrease the possibility of bacterial resistance (20). Raineri et al. (21) reported a relationship between appropriate antibiotic therapy and the reduction of ICU need and subsequent mortality rates. Since 2012, new dressings: Aquacel, comfeel, antibacterial agents and hydrogel was used. Hydrogel substance acts to encourage autolysis and debridement form and of moist media necessary for healing and enhance formation of collagenase in the wound, (22). Late surgical debridement (after 21 days) was used previously, during the period of the study. Early excision (within 2-7 days post burn) and grafting (allograft from nearest available relative or autograft from the patient him/herself) were applied. Pruitt et al and Xiao et al, suggested that early burn wound excision that permits elimination of the necrotic avascular tissue will lead to a decrease in sepsis incidence and subsequent mortality (18, 20). Early BW excision led to shorter periods of hospitalization, and it has been recommended by other studies (23).

Conclusion:

ICMs can reduce NIs in burn centers. Wise usage of antibiotics and baths, new dressings, early excision and grafting are vital and recommended.

Authors' contributions:

Mohannad Kamel Al-Bermani: Selection of study subject, study conception, selection of samples, acquisition of data, critical revision, writing of manuscript, designs the protocol of the study.

Waleed Abdul Hussain Salman: Selection of samples, acquisition of data, writing of manuscript, interpretation, collection and analyses of data.

Gulala Khalid Hamad: Selection of samples support in writing the theses, drafting and manuscript, statistical analysis

Eman Abdul yemmah Hadi: Selection of samples support in writing the theses, drafting and manuscript.

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دراسة اجراءات السيطرة على العدوى في تقليل معدلات عدوى المستشفيات في مركز الحروق التابع لمدينة الطب

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الخلاصة:
الخلفية العلمية: استنادا الى ان عدوى المستشفيات هي من المضاعفات الخطيرة في وحدات الحروق، فيكون تسمم الدم الجرثومي في المرضى الذين يعانون من الحروق الشديدة هو السبب الرئيسي للوفاة، وان تطبيق برنامج السيطرة على العدوى يساعد في خفض معدلات عدوى المستشفيات ومعدل الوفيات اللاحقة في مركز الحروق.
الهدف: إظهار تأثير تدابير السيطرة على العدوى في خفض معدل عدوى المستشفيات في مركز الحروق التابع لمدينة الطب.
المرضى والطريقة: دراسة اعتمدت مراجعة ملفات المرضى أجريت في مركز الحروق التابع لمدينة الطب في بغداد خلال ثلاث سنوات من مايو 2012 إلى مايو 2015. راجع المركز 1977 مريضا خلال مدة الدراسة. تمثل هذه المستشفى مركز الحروق المرجعي الثالثي في بغداد، وبالتالي فانه يستقبل المرضى الذين يعانون من حروق شديدة. وقد تم تطبيق برنامج مكافحة العدوى من قبل فريق السيطرة على العدوى في أبريل 2012. وخلال فترة الدراسة تم الامتثال لتعليمات فريق السيطرة على العدوى بصورة تامة.
النتائج: انخفضت معدلات الاصابة بعدوى المستشفيات، كما انخفضت معدلات الوفيات، وانخفض متوسط فترة الرقود في المستشفى للمرضى الذين يعانون من عدوى المستشفيات، وانخفضت أعداد الإصابات بالتهاب جرح الحرق وتسمم الدم، وانخفضت معدلات المقاومة للمضادات الحيوية من البكتيريا السالبة والسلالات المقاومة للحمى الزنجارية.
الاستنتاج: يمكن تقليل معدلات الاصابة بعدوى المستشفيات من خلال إجراءات السيطرة على العدوى في وحدات الحروق. ينبغي أن يكون استخدام المضادات الحيوية عقلانيا. يجب عدم استخدام الحمامات إذا أمكن. استخدام الضمادات الحديثة، والهندمة المبكرة لجرح الحرق، وعمليات ترقيع الجلد هي الدعائم الأساسية للعلاج.
كلمات البحث: التهاب جرح الحرق, عدوى المستشفيات, تدابير السيطرة على العدوى.