Infection in long term care facility in the kingdom of Bahrain

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Summary Infections in long term care facilities (LTCF) are common and are considered a major cause of mortality and morbidity. Endemic infections and outbreaks are observed in LTCF. Of particular concern is the growth of multi-drug resistant organisms. A study was conducted in the Kingdom of Bahrain concerning infections among the residents in a LTCF. The aim was to define the rate, type and outcomes of institutional infections. The different treatment modalities and antimicrobials used were evaluated. Our facility cares for the elderly and a heterogeneous group of patients from different populations (e.g., mentally retarded, bedbound due to various disabilities and other forms of consciousness impairment such as post stroke disability, cerebral palsy and anoxic brain damage). The initial span of six months was changed to seven months to increase the sample size and improve the data analysis. This was a prospective study conducted in Muharraq Geriatric Hospital in the Kingdom of Bahrain. The study was conducted over seven months from January 2013 to July 2013 on 104 patients. During that period, patients with new positive cultures from different sites were included. The clinical features, microbiological features and outcomes of the bacteremic episodes were included. The information was collected by a questionnaire created by the research team. From a total of 104
Introduction

Long term care facilities (LTCF) provide a spectrum of institutional health care programs and services outside the acute care hospital. A growing number of geriatric patients are receiving care in LTCF. Infections in these facilities are very common and represent a major cause of morbidity and mortality among the elderly. Residents are gathered in a confined space with activities taking place in groups. Some of the residents have impaired cognitive abilities and poor self-hygiene. Caregivers are poorly trained in infection control practices. Understaffing problems in these nursing homes are common. The elderly are predisposed to infection particularly because they are physiologically old and they suffer a list of co-morbidities. It is sometimes difficult to diagnose infections in the elderly, which delays the detection and treatment of infections.

Endemic infections and outbreaks are observed in LTCF. Of particular concern is the growth of multi-drug resistant organisms, such as extended spectrum beta-lactamases, methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE). The most common infections are respiratory tract infections, urinary tract infections, gastrointestinal infections and skin infections. It is estimated that approximately 60% of lower respiratory infections are pneumonias, which are often fatal. Urinary tract infections are the most common infection in long-term care facilities for the elderly. The prevalence rates of bacteriuria are 25–50%, though most patients remain asymptomatic. Skin and soft tissue infections include decubitus ulcers, infected vascular or diabetic foot ulcers and other types of cellullitis. Gastrointestinal infections primarily manifest as diarrhea [1].

In Frankfurt am Main, Germany, 288 patients from two geriatric clinics (n = 46), eight nursing homes (n = 178) and two ambulant care facilities (n = 64), and 64 staff members were screened for MDRB between October 2006 and May 2007. Fifty-eight patients (20.1%) and four staff members (6.2%) were colonized with MDRB. Among the patients, 27 (9.4%) were colonized with MRSA, 11 (3.8%) screened positive for VRE, and 25 (8.7%) were colonized with ESBL producing Enterobacteriaceae. The prevalence rates of MDRB in geriatric clinics, nursing homes, and ambulatory care facilities were 32.6%, 18.5% and 15.6%, respectively. Significant risk factors for MDRB were immobility (OR: 2.7, 95% CI: 1.5–4.9; p = 0.002), urinary catheters (OR: 3.1, 95% CI: 1.7–5.9; p < 0.001), former hospitalization (OR: 2.1, 95% CI: 1.1–4.0; p = 0.033) and wounds/decubiti (OR: 2.3, 95% CI: 1.5–4.9; p = 0.03). The high level of MDRB in geriatric clinics, nursing homes, and ambulatory care facilities indicate the importance of these institutions as a reservoir for dissemination [2].

A study was conducted in the Kingdom of Bahrain regarding infections among residents a LTCF. The aim was to define the prevalence, type and outcomes of institutional infections. The different treatment modalities and antimicrobials and antimicrobial resistance were evaluated to assess the status of infection control programs in the facilities. Our facility cares for the elderly and a heterogeneous group of patients from different populations (e.g., mentally retarded, bed bound patients and patients with other forms of consciousness impairment).

Materials and methods

A prospective study was conducted in Muharaq Geriatric Hospital in the Kingdom of Bahrain. The study was performed over seven months from January 2013 to July 2013 in 104 patients (the full capacity of the hospital). The initial span of six months was changed to seven months to increase the sample size and improve the data analysis.

A data form was compiled. Important risk factors, comorbidities, medications and other important parameters were agreed upon. The form was reviewed and finalized before the start of the study.

All of the patients who developed symptoms suggestive of infections (i.e., fever, poor feeding, dysuria, diarrhea, altered mental status) had a full septic work up performed. The patients who
developed positive cultures were enrolled in the study. Because the study was observational, there was no interference with regards to isolation, medication and other forms of care. The patients were followed up, and the outcomes were noted with the other data in the data form. The clinical features, microbiological features and the outcomes of the bacteremic episodes were included.

No consent was obtained because no interference with the management of the patient occurred. The data collection was confidential, and no personal information was collected.

The results from the data forms were compiled and entered into an Excel sheet. This was a purely descriptive study, and no statistics could be obtained from the data.

**Results**

During a period of six months, a prospective collection of LTFC residents with positive cultures was reviewed. From a total of 104 patients residing in the LTFC, 19 had positive cultures from different sites at different times. The average age for the residents with positive cultures was 61, and the average length of stay was two years.

Of the 19 patients, 47.37% and 52.63% were males and females, respectively. Twelve out of 19 residents (63%) had multiple positive cultures from different locations at the same time or at different times. *Escherichia coli* (*E. coli*) was the most common isolated organism (57.89%). Of the *E. coli* specimens, 55.56% (*n* = 5) were extended spectrum beta lactamase (ESBL) isolates. Of the eleven patients with *E. coli* infections, nine specimens were from urine cultures (81.81%), and one was a blood culture 9.09% and one was a wound 9.09% (Graph 1).

**Graph 1** Rates of the different types of infections at various sites among the study population.

**Graph 2** The rates of different comorbidities. (Included in the graph is any comorbidity that was noted in three or more patients.)

Gram negative ESBL isolates were common in the residents. Eight cases were reported positive with ESBL. Six of these isolates were from urine (75%), one case was from blood and another case was from a wound site. Regarding the organism type, 62.5% (*n* = 5) were *E. coli* and 37.5% (*n* = 3) were *Klebsiella*.

Multi-drug resistant (MDR) organisms were grown in various culture results. Five out of the nineteen patients grew MDR organisms (26.32%). Eighty percent were *Acinetobacter* species, and one case was positive for pseudomonas. Two out the five cases were from deep tracheal aspirates (DTA), two from urine cultures and one was from sputum.

*Methicillin resistant Staphylococcus aureus* (MRSA) represented a significant portion of the infections. Four cases were reported to be MRSA (21%). Two cases were isolated from DTA, one as from a urine sample and one was from a wound site. One patient had scabies and was treated after a dermatology consultation with topical medications.

A total of 39 positive cultures were reported. Some of the cultures were from the same patients (positive cultures from different sites at various times). Urinary tract cultures represented 48.72%. The next most common sites were body wounds, such bedsores, and the proportion of these infections was estimated to be 18%. DTA isolates represented 13.59%. The rest of the cultures were from blood, sputum and the tips of central lines.

The patients were known to have multiple co-morbidities. Significant recurrent conditions included bedbound patients, diabetes mellitus type 2 and hypertension (Graph 2). The most common co-morbidity was diabetes mellitus type 2 (47.375). Five of the diabetic patients received subcutaneous insulin injections of different regimens, two of them were on oral hypoglycemic agents and two were not on any treatment. The majority of the patients were bed bound with very limited
movement if any at all. These patients are totally dependent on the nursing staff for feeding and other health care services. Their mini mental state evaluation scores were approximately zero.

The patients who had positive cultures were assessed by the assigned medical doctor in the LTFC for possible initiation of treatment. Nine out of the nineteen patients were transferred to a secondary care hospital for further management and evaluation. Three of these nine patients expired, typically from septic shock and multi-organ failure. Five were discharged back to the LTFC, and one remained admitted to the hospital on invasive pressure ventilation at the time of this report. Antibiotics were prescribed to the patients as needed. Meropenem was used in nine of the patients (47.37%) at various doses depending on the age and renal function. The majority of the patients had a urinary infection, and *ESBL* was the most common isolate, explaining why the most commonly used antibiotic was meropenem. The patients who received meropenem had the most successful results (Graph 3). Because a large number of patients received meropenem as treatment, the related outcomes were graphed versus the patients who did not receive meropenem (Graph 4).

The symptoms and sings were vague in all of the LTFC residents. The patients varied between being asymptomatic, with cultures collected as a screening routine, to having symptoms such as insomnia, increased irritability, fever, vomiting, cough with hypotension and a drop in oxygen saturation.

Blood studies were performed on the patients after they a reported positive culture. The white cell count was normal (between 4 and 10) in 63.16% of the residents. The rest of the patients had a high count (more than 10). No obvious abnormalities were noticed in the other blood studies (e.g., renal function, serum electrolytes).

Because proper isolation rooms were not available in the LTFC, not all cases were isolated after a highly contagious infection was detected. Five cases were isolated with contact precautions, and one case was isolated with both contact and droplets. Three of these patients had UTI with a gram-negative *ESBL* organism, and two had DTA infections (one MDR, one MRSA). The other two cases were reported to have scabies and wound MRSA.

A hand hygiene policy was implemented by the staff nurses and applied to the patients. There was no direct observation of the policy by the data collectors, but it was based on questioning of the caregivers. There could be some bias on this point. All of the patients had up to date pneumococcal and influenza vaccines. This is part of the Public Health Directorate in Ministry of Health policy to
minimize the incidence of new infections among the residents.

Discussion

As shown by the results above, there was a considerable number of patients with infections acquired in the LTCF. Virulent organisms such as MRSA and gram negative ESBL and MDR were isolated in a significant number of patients. This raises major concerns regarding the hygiene of the residents and the aseptic precautions implemented by the assigned staff. Facilities caring for mostly elderly patients should be under close observation for sterility because these centers are caring for immunocompromised residents. As a part of aging, the elderly have diminished immune responses, including phenotypic and functional changes in T cells. These changes are of limited clinical significance in healthy elderly individuals. Immune dysfunction in elderly residents of LTCFs is primarily driven by multiple factors that result in secondary immune dysfunction, such as malnutrition, the presence of multiple chronic diseases and polypharmacy, especially with medications that diminish the host defenses (e.g., immunosuppressants) [3,4].

Urinary tract infections are the prevailing infections in nursing homes. In most surveys, the leading infection in LTCFs is UTI [5]. Bacteriuria is very common in residents of these facilities but, by itself, it is not associated with adverse outcomes and does not affect survival. Bacteriuria and UTI are associated with increased functional impairment, particularly incontinence of urine or feces [6,7]. Because the prevalence of bacteriuria is high, a positive urine culture, with or without pyuria, is not sufficient to diagnose a urinary infection. Clinical findings for the diagnosis of a UTI in the non-catheterized resident must include some localization to the genitourinary tract. The diagnosis requires a positive quantitative urine culture. This is obtained by the clean-catch void technique, by in and out catheterization or by aspiration through a catheter system sampling port [8].

Catheterization predisposes to clinical UTIs, and the catheterized urinary tract is the most common source of bacteremia in the LTCFs. Residents with indwelling urinary catheters in the LTCF are uniformly colonized with bacteria, which is largely attributable to biofilms on the catheters. It is inappropriate to screen asymptomatic catheterized residents for bacteriuria or to treat asymptomatic bacteriuria. Specimens collected through a catheter that is present for more than a few days should always be evaluated for bacterial growth.

The table summarizes the type, site, and number of organisms isolated from the LTCF.

<table>
<thead>
<tr>
<th>Gram negative organism</th>
<th>Candida</th>
<th>Other α</th>
<th>Other β</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli/ESBL</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pseudomonas</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Actinobacter</td>
<td>sensitive/ MDR</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Staphylococcus (MRSA/MSSA)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>Blood</th>
<th>Urine</th>
<th>DTA/spitum</th>
<th>Wound</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>3</td>
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</tr>
<tr>
<td>Proteus</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Staph.</td>
<td>epidermidis</td>
<td></td>
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The incidence of new infections among the residents.
days reflect biofilm microbiology. For the residents with chronic indwelling catheters and symptomatic infections, changing the catheter immediately prior to instituting antimicrobial therapy allows for the collection of a bladder specimen, which is a more accurate reflection of the infecting organisms [9].

As seen from the results, 18% had wound infections (bed sores) that were treated according to the organism grown from the culture. Pressure ulcers (also termed decubitus ulcers) occur in up to 20% of residents in LTFCs and are associated with increased mortality [10]. Infected pressure ulcers are often deep soft-tissue infections, and the patient might have underlying osteomyelitis. Secondary bacteremic infections have a 50% mortality rate. They require costly and aggressive medical and surgical therapy. Once infected, pressure ulcer management requires a multidisciplinary approach with the involvement of nursing, geriatrics and infectious disease specialists, surgery and physical rehabilitation. The prevention of pressure ulcers involves developing a plan for turning, positioning, eliminating focal pressure, reducing shearing forces and keeping skin dry. Attention to nutrition, using disposable briefs and identifying residents at a high risk using prediction tools could prevent new pressure ulcers.

The majority of the patients who had positive cultures received antimicrobial agent(s) to treat the underlying possible infections. There could be an element of overuse of the antibiotics, especially because some of the positive cultures could reflect colonization rather than actual infection.

This study was limited by its use of only one long term healthcare facility. Because Bahrain is a small country, only one long term healthcare facility was under the jurisdiction of the Ministry of Health. The sample was limited, necessitating the increase of the duration of the study by one month. If the study was expanded to involve other facilities over a longer period of time, a proper statistical analysis could have been performed.

Physicians should be educated regarding the proper use of antibiotics. Establishing criteria that, at a minimum, should be present before initiating antibiotics is a potentially important strategy for optimizing antibiotic use in nursing homes. Short-course, narrow-spectrum antibiotic therapy should be used whenever possible [11].

Part of the LTFC protocols is to annually vaccinate all residents for influenza and to give pneumococcal vaccines every five years. This protocol has been established by Bahrain’s Ministry of Health for a couple of years. The residents of nursing homes are at a higher risk of being exposed to influenza because the virus is more likely to be introduced and spread in an institutional setting. In addition to being in close contact with other residents, nursing home residents are also exposed to many other people, such as staff members, volunteers and visitors. The high morbidity and mortality associated with influenza underscores the importance of annual immunization programs. Elderly people might have a relatively low antibody response to vaccines, but studies have shown that when vaccinated nursing home residents become infected, their illness is often milder and of shorter duration than in unvaccinated residents, and they are less likely to develop complications. In a systematic review, the authors found that in nursing homes, the overall effectiveness against pneumonia, hospitalization and deaths from influenza was 46%, 45% and 42%, respectively, when the vaccine matching was good. They found that all-cause mortality was reduced by 60%. Vaccination showed a limited effectiveness in the prevention of influenza-like illness and no effectiveness for the prevention of influenza [12].

Another strategy to reduce transmission within the setting of nursing homes involves the vaccination of staff members. Because staff members are relatively young and healthy, they are more likely to develop protective post-vaccination antibody titers than are the residents. High rates of vaccination among the staff might contribute substantially to the herd immunity within the nursing home by reducing the potential for the introduction and spread of the virus. The results of three recent studies have shown that staff immunization reduced mortality by 40%. The effective staff member vaccination rates in these three studies were 60%, 51% and 48% [13–15].

Multiple patients grew MRSA in different body areas (e.g., blood, DTA). Numerous studies conducted in acute hospitals have identified admission from nursing homes as a major risk factor for MRSA carriage and vice versa. The available data show prevalence rates of MRSA colonization varying between 0% to more than 40% [16]. It is not clear why MRSA is endemic or epidemic in some nursing homes but not in others. When colonized residents have been compared with non-carriers, increased age, underlying chronic disease, decreased mobility, impaired cognitive status, presence of intravenous, urinary or enteral feeding devices, presence of wounds, recent use of antibiotics and recent hospital stays were frequently associated with MRSA carriage. MRSA could be acquired de novo under the selective pressure of antibiotic use. Transferring patients between hospitals and nursing homes is common, and some
studies suggest that most nursing home residents acquire their MRSA carriage in a hospital rather than in the nursing home, creating a two-way flow of MRSA [17]. It is assumed that indirect transmission from the hands of staff members presents the major mode of spread of MRSA within a nursing home. Direct transmission from resident to resident has been described but seems rather uncommon. One study showed that the likelihood of MRSA carriage for a patient sharing a room with an MRSA-positive person was almost five times higher when compared with residents with an MRSA-negative roommate. The environment has been noted to be an uncommon source for the transmission of MRSA within the setting of nursing homes [18].

There are certain guidelines that could be followed to minimize the onset of new infections among the residents and to decrease the transmission of infections from the assigned staff to the residents and between residents themselves. From the residents’ aspects, assessments of all residents for any/all changes in symptoms or conditions that might be indicative of an infection should be performed on an ongoing basis, including clinical observations, house reports, chart and/or Kardex reviews and culture reports [19]. Any change in the resident’s condition is to be reported to the private physician. Indications of infections in the elderly might be different from those seen in a younger, healthier population. Elderly persons often have a lower body temperature, so an increase in temperature from that which is normal for the resident might be an indication of infection. Routine culturing of any resident or group of residents should not be performed unless one of the following occurs: (1) the resident has clinical signs or symptoms. A culture performed under these circumstances will be useful in treating the resident; (2) an outbreak situation. Routine culturing of asymptomatic residents at admission or prior to admission is not recommended. An assessment of the resident at the time of admission to the facility for communicable diseases and a history of immunization is needed. This will assure recognition of communicable diseases that will require special precautions and assure that the resident is up-to-date on recommended adult immunizations [20].

From the employees’ aspect, all new employees should have a baseline health assessment, including a review of their immunization status and their history of relevant past or present infectious diseases. The past history of infectious diseases should include chickenpox, measles, hepatitis, skin boils and bacterial diarrhea. The use of screening cultures is rarely indicated. All new employees and volunteers should have a two-step tuberculin skin test using the Mantoux method unless the employee reports a history of a positive tuberculin skin test. Annual tuberculosis evaluations of employees and volunteers should be performed. Walking rounds to observe environmental conditions should be performed on a regular basis or at least twice monthly [20].

Observations should be made regarding equipment decontamination and cleaning procedures in bathroom/tub areas, physical therapy, medication/treatment rooms, kitchen and laundry areas. Observations should be made for hand-washing, the availability of soaps and paper towels, handling of sharps/infectious waste, care of resident supplies for skin care, catheter care and feeding solutions [20].

Conclusion

This survey of infections in LTCF in the Kingdom of Bahrain showed a significant number of infections, with virulent infections representing a significant burden. This study shows that infection control programs to be implemented more strictly. More frequent surveillance strategies should be used in the nursing home. The feasibility of decreasing or preventing high colonization rates with drug-resistant microorganisms in long-term care facility residents needs to be assessed because most patients acquire these microorganisms in acute-care facilities. Practices related to antimicrobial drug use are key to this question.

Infection control can only be successful if it is considered a duty of the entire institution. Coordination with general physicians is essential for infection control. Early and specific diagnosis and a rational therapeutic approach are important for controlling the infection and limiting its spread. The attending physician should ensure the proper documentation of all medical decisions and strict adherence by the nursing personnel. There is a need to develop performance indicators for infection prevention. Our facilities would greatly benefit from the implementation of an antimicrobial stewardship program.

Conflict of interest

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Competing interests: None declared.

Ethical approval: Not required.
References