

Original article

Isolation and Identification of Pathogenic Bacteria from Hospital Door Handles/knobs

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ABSTRACT

Background and objectives. Contracting infectious diseases from microbial contaminated door handles is a potential threat to health and safety. Therefore, we performed microbiological screening of door handles at the door handles of Zawia Education Hospital, Zawia, Libya, to estimate the presence of potentially pathogenic organisms. **Methodology.** A total of 125 samples were collected aseptically by using a moistened sterile bacteriologic swab on different days by scrubbing the selected handles and immersing them in the sterile broth to be transported to the microbiology laboratory, within no more than 30 minutes after collection. All the bacterial isolates were characterized and identified by standard diagnostic microbiological procedures and criteria, according to the Clinical and Laboratory Standards Institute. Data were presented as counts and percentages using Excel spread data sheath. **Results:** There was a total of 147 isolates obtained from the 12 sampled departments. The frequency of isolation of these organisms from these samples was as follows: coagulase-negative staphylococcus (16.80%) in 21 samples, Staphylococcus aureus (10.40%) in 13 samples, Diphtheroid (76.00%) in 95 samples, non-lactose fermenting gram negative bacilli (12.80%) in 16 samples, streptococcus pyogenes (0.80%) in one sample, and Klebsiella pneumoniae (0.80%) in one sample. **Conclusion.** Staphylococcus aureus, coagulase negative staphylococcus, streptococcus pyogenes, klebsiella pneumoniae, Diphtheroid, and non-lactose fermenting gram-negative bacilli were the main bacteria isolated in this research study. The results of the present study demonstrated that contact surfaces such as door handles are often colonized by several bacteria and serve as a potential source of infections.

Keywords: Nosocomial Infections, Door Handles, Cross-Contamination, Pathogenic Organisms.

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الخلفية والأهداف. إن الإصابة بالأمراض المعدية من مقابض الأبواب الملوثة بالميكروبات تشكل تهديدا محتملا للصحة والسلامة. لذلك، قمنا بإجراء فحص ميكروبيولوجي لمقابض الأبواب عند مقابض أبواب مستشفى الزاوية التعليمي، الزاوية، ليبيا، لتقدير وجود الكائنات الحية المسببة للأمراض. **طرق الدراسة.** تم جمع 125 عينة بطريقة معقمة باستخدام مسحة بكتريولوجية معقمة مبللة في أيام مختلفة عن طريق فرك المقابض المختارة وغمرها في المرق المعقم لنقلها إلى مختبر الأحياء الدقيقة، خلال مدة لا تزيد عن 30 دقيقة بعد جمعها. تم تشخيص وتحديد جميع العزلات البكتيرية من خلال الإجراءات والمعايير الميكروبيولوجية التشخيصية القياسية، وفقا لمعهد المعايير السريرية والمخبرية. تم تقديم البيانات كأعداد ونسب مئوية باستخدام نظام أكسل. **النتائج.** كان هناك ما مجموعه 147 عينة تم الحصول عليها من 12 القسم. وكانت نسبة تكرار عزل هذه الكائنات من هذه العينات كما يلي: المكورات العنقودية سالبة المخثرة (16.80%) في 21 عينة، المكورات العنقودية الذهبية (10.40%) في 13 عينة، الدفترويد (76.00%) في 95 عينة، سالبة لجرام غير مخمرة اللاكتوز. العصيات (12.80%) في 16 عينة، العقدية المقيحة (0.80%) في عينة واحدة، والكلبسيلا الرئوية (0.80%) في عينة واحدة. **الاستنتاج.** المكورات العنقودية الذهبية، المكورات العنقودية سالبة المخثرة، العقدية المقيحة، والكلبسيلا الرئوية، الخناق، والعصيات سالبة الغرام غير المخمرة للاكتوز هي البكتيريا الرئيسية المعزولة في هذه الدراسة البحثية. أظهرت نتائج الدراسة الحالية أن الأسطح الملامسة مثل مقابض الأبواب غالبًا ما يتم استعمارها بواسطة العديد من البكتيريا وتكون بمثابة مصدر محتمل للعدوى.

INTRODUCTION

Healthcare Acquired Infections (HCAs) continue to threaten the quality of patient care, and it is considered a major cause of morbidity and mortality worldwide [1]. In the United States, it is estimated that about 1.7 million people develop nosocomial-related illnesses yearly, and approximately 99,000 of them die [2].

Nosocomial pathogens are organisms causing diseases that are acquired from the hospital and healthcare environment within a few days of admission and are responsible for nosocomial infections [3], an endogenous bacterial flora is considered the main source of nosocomial infections, however, 20 to 40 % of nosocomial infections are caused by cross-contamination [4].

These nosocomial pathogens may remain infectious on the surfaces for weeks after the contamination event depending on the environmental conditions [5], and some of these bacterial pathogens have become antibiotic resistant, which is a major public health crisis facing the world today [6,7].

Recent studies have shown the presence of bacterial pathogens on hard, nonporous surfaces such as kitchen surfaces, floor surfaces, toilet surfaces, door handles, etc. [8], from which pathogens are easily transmitted to unsuspecting members of the public posing a potential risk to vulnerable, immunocompromised individuals [9]. Door handles, in Hospitals and in public, are the most commonly touched surfaces, and bacteria can easily be transferred from person to person by this way, constituting a major source of the spread of infectious diseases [10].

So, much progress has been achieved with interventions relating to hand hygiene, cleaning regimes, and strict infection control monitoring [11].

Evaluation and monitoring of hospital door handles is necessary for infection control because there is a possibility that contaminated door handles may increase the risk of acquiring infections that often result from contact with door handles contaminated by people who do not practice hand hygiene [12].

Door handles may also get contaminated by gloves and other cross contaminated objects and subjects found within the hospital environment [13]. Otter et al. (2011) reported that surfaces can play an important role in the epidemic and endemic transmission of the major pathogens linked to healthcare associated infections [14].

Some of the most important species that may be found on the hand as transmitted species from external sources include *Staphylococcus spp*, *Escherichia coli*, *Salmonella spp*, *Shigella spp*, and *Clostridium* at a high rate [15].

The hospital infection control committee has employed various standard precautions to prevent the hospital acquired infections. This study aimed to estimate the presence of potentially pathogenic organisms, at door handles of Zawia Education Hospital.

METHODS

Study area and sample collection

This cross-sectional study was carried out on 125 door handles of Zawia Education Hospital, Zawia City, Libya. Ethical approval of the study protocol was obtained from the Zawia Education Hospital committee. The study was carried out from May to June 2022 on different days, selected from frequently touched door handles in 12 different departments (Out Patient Department of a hospital, General Surgery Department, Operation Theatre, Intensive Care Unit, Obstetrics and Gynecology Department, Female Surgical Department, Male Surgical Department, Pediatric Department, Neonatal Intensive Care Unit, Outpatient Clinics, and Laboratory) of Zawia Education Hospital.

Door handles of buildings that were not in use during sampling were excluded from the study.

A total of 125 swab specimens were conveniently collected using sterile swabs moistened with nutrient broth were used to obtain the samples by scrubbing the selected handles and immersing them in the sterile broth to be transported to the microbiology

laboratory, within no more than 30 minutes after collection.

Bacterial isolation and identification

Inside the laboratory, the collected samples were incubated at 37°C for 18 - 24 hours to allow microbial growth. After that, samples were inoculated on Nutrient Agar (NA), Blood agar (BA), Trypticase soy agar (TSA), Mannitol salt agar (MSA), and MacConkey agar (Mac) in an aseptic manner.

All the inoculated plates were incubated under aerobic conditions at 37°C for 24 hours to observe the developed colonies.

The characteristics of the cultures, including colony morphology, pigment production, sugar fermentation (e.g., lactose fermentation), catalase test, coagulase test, hemolysis, and swarming growth were examined. The selective and differential characteristics of each agar medium were recorded. Biochemical tests were also carried out to further identify the various bacterial isolates as described by standard biochemical analysis [16].

Data analysis

Descriptive statistics were used to present the results in the form of counts and percentages, using Microsoft Excel data sheath.

RESULTS

This study intended to study the prevalence of pathogenic bacteria among door surfaces in Zawia Education Hospital. The following were the frequencies of the contaminated door handles in each department that were involved in the study (Table 1). The different organisms isolated from the sampled 125 Hospital door handles are shown in Table 2 and figure 2. There was a total of 147 isolates obtained from the 12 sampled departments. The frequency of isolation of these organisms from these samples was as follows: *coagulase-negative staphylococcus* (16.80%) in 21 samples, *Staphylococcus aureus* (10.40%) in 13 samples, *Diphtheroid* (76.00%) in 95 samples, *non-lactose fermenting gram negative bacilli* (12.80%) in 16 samples,

streptococcus pyogenes (0.80%) in one sample, and *Klebsiella pneumoniae* (0.80%) in one sample.

Table 1. Frequency of contaminated door handles

Department	Frequency of contaminated door handles/ Size of isolates (%)
Outpatient Department of a hospital	14/15 (93.3%)
General Surgery Department	7/8 (87.5%)
Department of Radiology	7/8 (87.5%)
Operation Theatre	7/7 (100%)
Intensive Care Unit	10/10 (100%)
Obstetrics and Gynecology Department	14/14 (100%)
Female Surgical Department	9/10 (90%)
Male Surgical Department	12/12 (100%)
Pediatric Department	15/16 (93.75%)
Neonatal Intensive Care Unit	8/9 (88.8%)
Outpatient Clinics	11/11 (100%)
Laboratory	5/5 (100%)

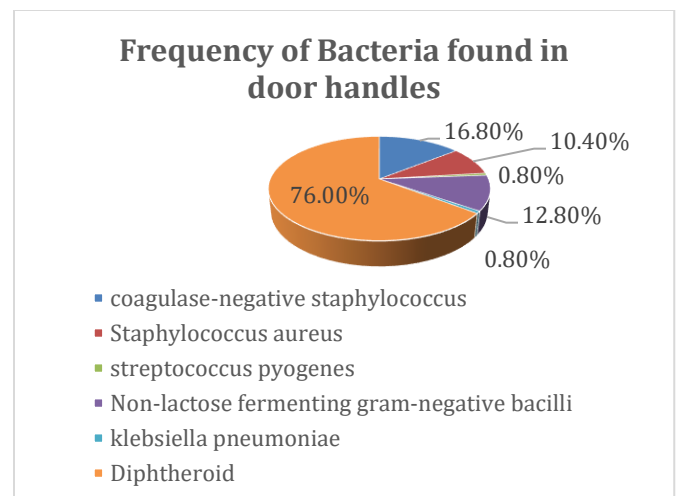


Figure 1. The different organisms isolated from the sampled Hospital door handles.

Table 2. The distribution of bacterial isolates by location.

Department	Bacterial isolates							
	Size of isolates	coagulase -negative staphylococcus	Staphylococcus aureus	streptococcus pyogenes	non-lactose fermenting gram-negative bacilli	klebsiella pneumoniae	Diphtheroid	no growth
OPD	15	3	1	0	1	0	10	1
General Surgery Department	8	3	0	0	1	0	5	1
Department of Radiology	8	1	1	1	0	0	5	1
OT	7	1	2	0	1	1	5	0
ICU	10	0	0	0	1	0	10	0
Obstetrics and Gynecology Department	14	1	1	0	2	0	11	0
Female Surgical Department	10	2	0	0	0	0	8	1
Male Surgical Department	12	1	0	0	1	0	12	0
Pediatric Department	16	3	4	0	1	0	10	1
NICU	9	3	2	0	3	0	5	1
Outpatient Clinics	11	1	1	0	3	0	11	0
Laboratory	5	2	1	0	2	0	4	0
Total		21	13	1	16	1	95	6

DISCUSSION

Door handles/knobs are touched whenever doors are used globally, this process thus transfers microbes from either hand to door handles or from door handles to hands vice-versa.

This study was aimed at isolation and identification of bacteria from door handles/knobs.

The results of this study also showed that Diphtheroid was the most predominant bacteria in all departments, while *coagulase negative staphylococcus* was most predominant in General Surgery Department 3/8, NICU 3/9, OPD 3/15, Pediatric

Department 3/16, Laboratory 2/5, and Outpatient Clinics 1/11.

Staphylococcus aureus was predominant in OT 2/7, NICU 2/9, Pediatric Department 4/16, Laboratory 1/5, Department of Radiology 1/8, Outpatient Clinics 1/11, and OPD 1/8, while non-lactose fermenting gram-negative bacilli was predominant in NICU 3/9, Outpatient Clinics 3/11, Laboratory 2/5, Obstetrics and Gynecology Department 2/14, OT 1/7, General Surgery Department 1/8, ICU 1/10, Male Surgical Department 1/12, OPD 1/15, and Pediatric Department 11/16, while a little presence of *klebsiella*

pneumoniae in OT, and *streptococcus pyogenes* in Radiology Department.

These organisms may probably get their way to the door handles through the skin and hand-to-hand contact.

The highest number of isolated bacteria from door handles were diphtheroid isolated in pure culture and mixed with other pathogenic bacteria. Diphtheroid is known as aerobic, non-sporulating, pleomorphic gram-positive bacilli which are more uniformly stained, lack the metachromatic granules and are arranged in a palisade manner. Although it usually commensals the skin and mucous membranes, it is frequently reported in association with nosocomial infections and a vast majority of these infections are exhibiting antibiotic resistance [17]. Diphtheroid are able to form a biofilm on medical equipment, which is difficult to treat and may cause chronic infection, for catheter and prostatic infections causing recurrent infections thereby to biofilm resistant to antibiotics [18]. This biofilm matrix causes antibiotic resistance and is responsible to delayed penetration of antibiotics into the microorganisms in the biofilm, as a cause of alteration of their physiological mechanism and growth rate due to the biofilm's manner of growth [19]. Diphtheroid were isolated in different door handles in this study, and were co-existed with pathogenic bacteria (G-ve) and (G+ve).

The overall prevalence of bacterial contamination in the Hospital door handles revealed by our study was 95% (119/125) was considerably high and capable of giving rise to nosocomial infections. Such contamination is suggestive of a variety of factors which may include; poor sanitation practices, poor decontamination, ineffective disinfectants used, and ineffective sterilization of medical care articles. In a similar study, door handles of offices in the Federal School of Medical Laboratory Technology Jos were evaluated for bacterial contaminants. The obtained results show that out of 30 samples assessed, 18 (60%) were contaminated [20]. Elsewhere in another study at the University of Port Harcourt Teaching Hospital.

A total of 329 micro-organisms were isolated, consisting of 253 bacteria (76.9%) and 76 fungi (23.1%). Gram-positive bacteria constituted 55.5% of the isolated bacteria, while 44.4% were Gram-negative [21]. whereas 85.8% was reported from research done in Muranga District Hospital [9].

CONCLUSION

Staphylococcus aureus, *coagulase negative staphylococcus*, *streptococcus pyogenes*, *klebsiella pneumoniae*, *Diphtheroid*, and *non-lactose fermenting gram-negative bacilli* were the main bacteria isolated in this research study. So, the results of the present study demonstrated that contact surfaces such as door handles are often colonized by several bacteria and serve as a potential source of infections. Contaminated and improperly washed hands contaminate door handles, that is to say, there is a high level of bacterial contamination which may lead to a high-level prevalence of bacterial infectious disease due to contaminants.

Based on the above findings, it is therefore recommended that the hospital management should at least provide hand sanitizers to the users or spray disinfectants with regular cleaning to ensure a reduction in microbial load, Individuals should adopt the habit of hand washing practice after using, this can prevent cross contamination, Besides the encouraging for general good hygiene practice by all (staffs, students and visitors), considering factors like the number of sites, the number of samples collected, conditions under which the research work was carried out, further research should be carried out particularly on the risk of fungal contamination.

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