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Sanitary Conditions of Alexandria Medical Research Institute Hospital

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Abstract. The present study took place over the period of one year, starting in autumn 2002 and ending in summer 2003 on the Medical Research Institute Hospital (MRIH). This work was conducted with the aim of evaluating sanitary conditions of MRIH. Concerning possible sources of nuisances outside and inside the hospital, there are several street vendors around the hospital and two groceries. Also, there are some refuse containers that could be sources of flies and cockroaches, apart from stray dogs and cats around the hospital. Regarding the tap water quality in the hospital, the residual chlorine level ranged between 0.2 to 0.6 mg/l in all samples around the year. The values were mostly in compliance with the permissible limits (0.2-0.5 mg/l). Microbiological examination of the water revealed the absence of colony forming units (CFU/ml) in most of the hospital units, except for the operation room where PC reached 20 CFU/ml in spring and summer, but never exceeded 50 CFU/ml, the maximum allowed CFU/ml in any water sample according to the WHO and the Egyptian standards. Total coliforms were not detected in any of the drinking water samples all around the year. As regards the hospital solid waste generation rate, it was found that 34.3% of the hospital waste was clinical waste, while 65.7% was domestic waste; and the total waste generation rate was 1.2 kg/patient/day.

Keywords: sanitary conditions, hospital, hospital solid waste, health care wastes, medical wastes, hospital sanitation, exposure.

Introduction

The place where the patient is treated has an important influence on the likelihood of his acquiring infection and on the nature of such infection (Ayliffe, *et al*., 1992). The hospital environment presents a dynamic risk of infection to employees, patients, visitors, and community. Hygienic internal and external hospital environment is a mandate for general suppression of hospital acquired infection (Saad and Shehata, 1994).

Few studies have been conducted to assess the sanitation of hospitals. A full environmental sanitation for the Medical Research Institute Hospital (MRIH) has never been studied; so, this work was conducted to evaluate the sanitary conditions of the MRIH.

Concerning the design planning of a hospital, there should be sufficient area for all buildings in the plan, with adequate surrounding space for natural illumination and ventilation, and with adequate provision for expansion. Spacious parking surroundings are also desirable to minimize neighborhood noise. At the same time, accessibility to transmission routes must be maintained (Health Department of Western Australia, 1998).

The hospital building should be set above the general surroundings to provide both an attractive appearance and good drainage. Still, the site should not be so high as to make the access to the hospital difficult for ambulant patients. Also, railway, bus lines, and other public transportation means should be accessible, without creating noise, smoke, or other nuisances (Haglund, *et al*., 1996; Health Department of Western Australia, 1998).

Nosocomial infections remain an important problem in developing countries (Wilson, 1995). A hospital-acquired infection may be defined as “any clinically recognizable microbiological disease, that affects the patient as a consequence of his being admitted to hospital or attending for treatment, or the hospital staff as a consequence of their work, whether or not the symptoms of the disease appear while the affected person is in the hospital”. Such infections may be caused by microorganisms acquired from another person in the hospital (cross-infection), from an inanimate object or substance that had not been recently contaminated from a human source (environmental infection), or carried by the patient before the appearance of the hospital-acquired disease (self-infection) (Parker, 1978).

The occurrence of outbreaks of nosocomial infection due to contaminated inanimate objects is often invoked as a basis for concern about endemic nosocomial infections attributable to the inanimate environment. Procedures for the surveillance and control of nosocomial infections were developed and tested for hospitalized patients, and they were not directly applicable to patients outside the hospital (Bennett and Brachman, 1992 and Craven and Stager, 1995).

Improving the hospital environment usually relies on maintaining very good sanitary conditions in the hospital. Environmental sanitation is generally defined by the WHO Expert Committee on Environmental Sanitation as "the control of community water supplies, excreta and refuse disposal, control of vectors of disease, housing conditions, food supplies and handling, atmosphere conditions, and the safety of the working environment" (Anaissie, *et al*., 2002).

Ideally, drinking water shouldn't contain any microorganisms known to be pathogenic or any bacteria indicative of fecal pollution. To ensure that a drinking water supply satisfies the guidelines, samples should be examined regularly. The detection of *Escherichia coli* provides definite evidence of fecal pollution; in practice, the detection of thermo-tolerant (fecal) coliform bacteria is an acceptable alternative. Coliform organisms have long been recognized as suitable microbial indicator of drinking water quality because they are easy to detect and enumerate in water (WHO, 1997).

Good sanitation and continuous removal of soiled surgical dressings and other hospital wastes are significant factors to ensure absence of cockroaches' breeding places. Weekly cleaning of all enclosed areas should be done to ensure absence of cockroaches' eggs (Saad and Shehata, 1994).

Hospitals discharge considerable amounts of chemicals and microbial agents in their wastewaters. Problem chemicals present in hospital wastewater belong to different groups, such as antibiotics, X-ray contrast agents, disinfectants, and pharmaceuticals. Many of these chemical compounds resist normal wastewater treatment. They end up in surface waters where they can influence the aquatic ecosystem and interfere with the food chain (Pauwels and Verstraete, 2006).

Healthcare wastes include all the waste generated by health care establishments, research facilities, and laboratories. Hospitals are one of major sources of healthcare waste (Prüss, *et al*., 1999a). Hazardous wastes have been defined by the Environmental Protection Agency (EPA) as wastes or combinations of wastes that pose or present a substantial potential hazard to human health or environment. Among the most hazardous wastes arising are the health care or medical wastes (Hussein, *et al*., 1999). The key to minimization and effective management of health-care waste is segregation and identification of the waste (Anaissie, *et al*., 2002 and Franceys, *et al*., 1992).

This work aimed at studying the existing environmental sanitary conditions of the Medical Research Institute Hospital and to evaluate the adequacy of the sanitary services available.

Materials and Methods

The present study was carried out through a descriptive cross-sectional approach.

Study of the main site characteristics of MRIH, with outside and inside possible sources of nuisances was carried out. The plumbing system for both drinking water supply and wastewater was investigated through an observation sheet Water samples were taken randomly from the tap water of each of the thirty-three units of the hospital for four successive seasons, amounting to a total of 660 samples (5 × 33 × 4). This study was carried out along one year starting from autumn 2002 to summer 2003, where October, January, April, and July represented the middle months of the four seasons. The water samples were subjected to residual chlorine measurement using a chloroscope, and bacteriological examination through total plate count, measured in colony forming units per ml [CFU/ml], and total coliform count, measured in most probable number per 100 ml [MPN/100ml]. Sample collection and examination were done according to the standard methods for examination of water and wastewater (Eaton, *et al*., 1995).

Domestic and clinical solid wastes generated over the day hours were collected separately. The amount of generated waste was weighed to determine generation rate in kg/day; unit generation rate in kg/patient/day, which represents the amount of waste generated from one patient per day:

$$\text{Unit generation rate in kg/patient/day} = \frac{\text{Generation rate in kg / day}}{\text{Number of patients in this day}}$$

The different clinical waste categories: infectious, pathological, sharps, pharmaceutical, genotoxic, chemical, radioactive, and pressurized containers (according to the WHO, 1997) and components (plastic, textile, rubber, metal, and glass) were determined through an observation sheet. In order to study the solid waste management, the managers, the heads of the nursing staff, and different employees were interviewed to collect information regarding collection, segregation, packaging, on-site and off-site transportation, treatment, and disposal of wastes.

The collected data were reviewed for accuracy and completeness, and appropriate statistical procedures were then applied (Sparks, 2000; Mason, *et al*., 2003).

Results and Discussion

Table 1 shows possible sources of nuisance outside and inside the MRIH. As regards outside sources of nuisances, it was found that there are several street vendors around the hospital and two groceries, but no market is present near the hospital. Also, there are some refuse containers that could be sources of flies and cockroaches, apart from stray dogs and cats around the hospital.

A bus stop and a micro-bus stop are present immediately near the hospital. Also a railway station is present near the hospital, although it is not immediately close to it. These sources may cause some noise and discomfort for the patients and health care workers or "health care providers". It was found that some stray cats are present in the MRIH, especially in the free medical and surgical wards, where patients of low social class stay for long time. They have poor hygiene and they have visitors bringing them food from outside the hospital, which can attract stray cats. Health and safety legislation places strong emphasis on the need to identify the hazards associated with any activity including the likelihood of pests being present. Having pests on a site leads to the transmission of disease. It is therefore very important that any pest prevention method should be carried out by those involved with the prevention program (Mathews, 1997).

Table 1. Outside and inside possible sources of nuisance at MRIH, Alexandria, 2003.

Items	Status
1- Outside sources of nuisance	
• Public toilets	-
• Markets	-
• Refuse containers	+
• Sewage overflow	-
• Railway station	+
• Tram station	-
• Bus stop	+
• Cemeteries	-
• Compact houses	-
2- In-side sources of nuisance	
• Cats	+
• Dogs	-
• Vectors	
- Rats	+
- Cockroaches	+
- House flies	+
• Overflow of solid waste containers	+

(+) present

(-) not present

The quality of plumbing systems for drinking water and waste water in MRIH is shown in Table 2. Regarding the plumbing system for drinking water, the examination revealed that there was leakage from some water taps in the free patients' wards in the hospital, which caused slippery wet floors in the bathrooms of these free patients' wards. Not less than three water taps were found leaking in the medical wards, and four were leaking in the surgical wards. On the other hand, no cracks or algal growth were found on the water pipes. However, there were no specially designed water taps, lavatories, or toilets for the disabled, although many patients at the hospital were elderly and disabled, and in need of assistance in the bathroom. Many health problems can result from slippery floors. In many parts of the world today, accidents have a public health importance calling for control and prevention. There are many accidents that result from the slippery wet floor surfaces, posing a

Table 2. Assessment of plumbing systems for drinking water and wastewater in MRIH, Alexandria, 2003.

Items	Status
1- Drinking water	
a- Cracks in pipes	-
b- Algae on pipes	-
c- Checking of quality of water pipes	-
d- Leakage from taps	+
e- Slippery floors	+
f- Presence of specially designed water taps, lavatories, and toilets for the disabled	-
g- Presence of a pumping station	-
h- Presence of emergency water tanks	-
i- Presence of a dual booster	-
j- Presence of chlorine booster	-
2- Wastewater	
a- Cracks in pipes	+
b- Algae on pipes	+
c- Presence of bad odor	-
d- Checking of sewerage system	-

(+) present

(-) not present

significant environmental risk factor. Fractures are the most known example often caused by a fall as a result of a slippery wet floor surface; especially in patients with long continued illness. Furthermore, it has been found that the incidence of such fractures is higher among individuals exposed to slipping accidents (Injury Control Council of Western Australia, 1997).

Table 3 represents seasonal means of residual chlorine (mg/l), plate count (CFU/ml), and total coliforms (MPN/100 ml) of drinking water in different units in MRIH. As regards the seasonal variation, it was found that in the autumn season, residual chlorine (R.Cl) ranged between 0.2-0.6 mg/l in all hospital units with a mean of 0.4 mg/l, and the plate count (PC) revealed that colony forming units were absent in most of the hospital units except in the operation room, where PC was 10 colony forming units per ml (CFU/ml) corresponding to a R.Cl of 0.2 mg/l. At the same time no coliforms were detected in any of the hospital sites.

Table 3. Seasonal means of residual chlorine (mg/l), plate count (CFU/ml), and total coliforms (MPN/100 ml) of drinking water in different units in MRIH, Alexandria, 2003.

Parameters and seasons Units	Seasons											
	Autumn			Winter			Spring			Summer		
	R.Cl	P.C	T.C	R.Cl	P.C	T.C	R.Cl	P.C	T.C	R.Cl	P.C	T.C
Operation room	0.2	10	ND	0.2	10	ND	0.2	20	ND	0.3	20	ND
Recovery	0.4	ND	ND	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND
New ward	0.5	ND	ND	0.5	ND	ND	0.5	ND	0	0.6	ND	ND
Surgical wards												
Surgery A	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Surgery G	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Surgery D	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Medical wards												
Female medicine	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND	0.6	ND	ND
Male medicine	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Dialysis unit	0.2	ND	ND	0.2	ND	ND	0.3	ND	ND	0.3	ND	ND
Coronary unit												
Class 1	0.4	ND	ND	0.3	ND	ND	0.5	ND	ND	0.5	ND	ND
Class 2	0.4	ND	ND	0.4	ND	ND	0.4	ND	ND	0.6	ND	ND
Free (charity)	0.4	ND	ND	0.3	ND	ND	0.3	ND	ND	0.4	ND	ND
Endoscopy unit	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Chemotherapy unit	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Pharmacies												
Private pharmacy	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.6	ND	ND
Fee pharmacy	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Human genetics lab	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Bacteriology lab	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND	0.6	ND	ND

Table 3. Continued.

Parameters and seasons Units	Seasons											
	Autumn			Winter			Spring			Summer		
	R.Cl	P.C	T.C	R.Cl	P.C	T.C	R.Cl	P.C	T.C	R.Cl	P.C	T.C
Parasitology lab	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Blood disease lab	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Radiology Unit	0.3	ND	ND	0.3	ND	ND	0.3	ND	ND	0.4	ND	ND
Chemical pathology lab	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Applied medical chemistry lab	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Physiology lab	0.6	ND	ND	0.6	ND	ND	0.6	ND	ND	0.6	ND	ND
Out patient clinics lab	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND	0.6	ND	ND
Biochemistry lab	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Immunology lab	0.5	ND	ND	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND
Pharmacology lab	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND	0.6	ND	ND
Tumor cell biology lab	0.4	ND	ND	0.4	ND	ND	0.5	ND	ND	0.5	ND	ND
Blood bank	0.2	ND	ND	0.2	ND	ND	0.3	ND	ND	0.3	ND	ND
Pathology lab	0.5	ND	ND	0.5	ND	ND	0.6	ND	ND	0.6	ND	ND
Mean	0.4			0.4			0.4			0.5		
± SD	0.009			0.01			0.01			0.009		

R.Cl: Residual chlorine
P.C: Plate count
T.C: Total coliforms
CFU : Colony forming unit
MPN : Most probable number
ND : Not detected
SD: Standard deviation

In the winter season R.Cl. ranged between 0.2-0.6 mg/l in all hospital units with a mean of 0.4 mg/l. The plate count revealed the presence of 10 CFU/ml in the operation room while the R.Cl was 0.2 mg/l. No colony forming microorganisms or coliforms were detected elsewhere in any of the other hospital units.

In the spring season, residual chlorine ranged again between 0.2-0.6 mg/l in all hospital units with a mean of 0.4 mg/l. The R.Cl. in the sample from the operation room was 0.2 mg/l, however bacteriological examination showed a plate count of 20 CFU/ml. As regards the most probable number (MPN) of coliforms per 100 ml, the data revealed that no coliforms were detected in any of the hospital units, not even the operation room.

In the summer season, residual chlorine ranged between 0.3-0.6 mg/l in all hospital units with an average of 0.5 mg/l. In spite of R.Cl of 0.3 mg/l in the sample obtained from the operation room, the plate count was 20 CFU/ml, but no coliforms were detected either in the operation room or elsewhere.

For water intended for drinking, WHO recommends that the plate count (PC) of any drinking water sample at any time should not exceed 50 CFU/ml and that *E. coli* or total coliforms (TC) must not be detectable in any 100-ml samples. WHO recommends regular sampling of treated water supplies and that not more than 5% of the samples in any 12-month period should test positive for *E. coli*. Residual free chlorine of 0.25 mg/l is considered adequate for warm climates (20± °C water supply). The residual chlorine suppresses re-growth of nuisance bacteria and guards against small amounts of recontamination of the water by reintroduced pathogens (World Health Organization, 1998).

The statistical analysis of above mentioned data revealed a significant difference in residual chlorine between summer and the different seasons, but no difference between autumn and winter, as the mean residual chlorine in both seasons was 0.4 mg/l.

Figure 1 shows the relationship between residual chlorine and the total coliforms in the operation room, where the plate count was high in drinking water. It reached 20 CFU/ml in summer in spite of R.Cl. being 0.3 mg/l, which could be explained by the increased activity of the microorganisms in the warmer seasons. It is also evident that a higher residual chlorine dose may be needed.

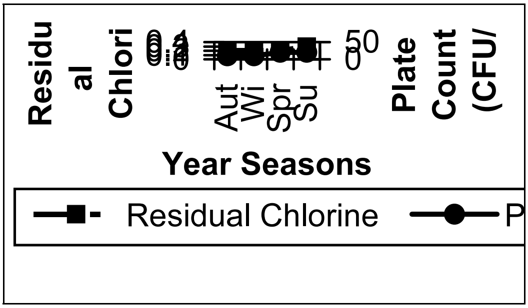

Fig. 1. Variations in residual chlorine and plate count of water obtained from the operation room during the 4 year seasons in MRIH, Alexandria, 2003.

During distribution of drinking water via the distribution system, the bacteriological quality of water may deteriorate. Coliform bacteria other than *E. coli* can occur in inadequately treated supplies, or those contaminated after leaving the treatment plant (WHO, 1997). So terminal disinfection is essential for surface water after treatment and for protected ground water sources when *E. coli* or thermo-tolerant (faecal, coliforms) are detected (Eaton, *et al*., 1995).

Wastewater from health-care establishments is of a similar quality to urban wastewater, but may also contain various potentially hazardous components, discussed in the following paragraphs. Hospitals wastewater discharge can have large amounts of chemicals and microbial agents. Pharmaceuticals and hormones are excreted by the patients into the wastewater. Unused medications are sometimes disposed of in drains. Also disinfectants enter the wastewater pipelines in large amounts. These compounds may reach drinking water, if they are not biodegraded or eliminated during sewage treatment. Additionally, antibiotics and disinfectants can disturb the wastewater biological treatment processes (Prüss, *et al*., 1999b and Kummerer, 2000). The wastewater discharge from the MRIH can contain all or some of the above mentioned chemicals, however no special pretreatment processes are done and the wastewater is directly discharged to the municipal sewers. The principle of uncoupling hospitals from public sewers warrants in-depth evaluation by technologists and ecotoxicologists as well as public health specialists (Pauwels and Verstraete, 2006).

The basic principle for effective wastewater management according to the WHO (Prüss, *et al*., 1999b) is a strict limit on the discharge of hazardous liquids to sewers. In countries that do not have epidemics of enteric disease and that are not endemic for intestinal helminthiasis, it is acceptable to discharge the sewage of health-care establishments to municipal sewers without pretreatment.

In the study by Chiang, *et al.* (2003), the disinfection of hospital wastewaters using the ozonization process was studied. It was found that ozone was very effective in the removal of microorganisms, biodegradable and some non-biodegradable wastes from the hospital's wastewater.

Table 4 shows solid wastes generation rate from different units in MRIH. Generation rate of domestic wastes ranged from 0.02 kg/pt/day to 1.5 kg/pt/day. Generation rate of clinical wastes ranged from 0.06 kg/pt/day to 2 kg/pt/day. Generation rate of domestic wastes of all the hospital was 0.8 kg/pt/day. Generation rate of clinical wastes of all the hospital was 0.43 kg/pt/day and hence, total waste generation rate was 1.2 kg/pt/day. It is clear that the average percentage of domestic waste was 65.7% of the total MRIH waste stream while the rest (34.3%) was of clinical nature. It is essential therefore that clinical material is not allowed to be packaged with normal domestic wastes.

These results are similar to that of Hall (1994), who reported that about 50% of wastes generated from hospitals are non-clinical. A similar study was conducted in Alexandria's hospitals by Abd El-Hamid (1997), who found that the domestic waste made up 55.6% of the total hospital waste produced. On the other hand, Abd El-Hamid (1997), in the same study reported different waste generation rates in different hospitals, *e.g.* Ibrahim Nada Hospital was the highest generator (3. 78 kg/patient/day) while Shark El-Madina Hospital was the lowest one (0.03 kg/patient/day).

Table 4. Solid wastes generation rate from different units in MRIH, Alexandria, 2003.

Units	Number of patients	Generation rate of domestic wastes		Generation rate of clinical wastes		Total
		GR of domestic waste in kg/day	GR of domestic waste in kg/pt/day	GR of clinical waste in kg/day	GR of clinical waste in kg/pt/day	
Theater	4	0.5	NA	8	2	
Recovery	4	2	NA	2	0.5	
New ward	11	15	1.4	2	0.18	
Surgical wards						
Surgery A	17	20	1.2	1	0.06	
Surgery G	7	10	1.4	2	0.29	
Surgery D	20	20	1	4	0.2	
Medical wards						
Female medicine	20	27	1.4	2	0.1	
Male medicine	12	18	1.5	1	0.08	
Dialysis unit	39	59	1.5	66	1.7	
Coronary unit	7	10	1.4	0.25	0.04	
Endoscopy unit	7	3	0.4	1	0.1	
Chemotherapy unit	30	0.5	0.02	6	0.2	
Pharmacies	NA	4	NA	NA	NA	
Labs	NA	10.75	NA	6.62	NA	
Radiology unit	NA	1	NA	1	NA	
Out patients clinics	75	6	0.08	5	0.06	
Total	253	206.75		107.87		314.62
Percentage		65.7		34.3		100.00

Recommendations

Based on the results of the present study, the following can be recommended.

- As regards the inside sources of nuisances in the MRIH, the abundance of insects and cockroaches can be controlled through using suitable and effective pesticides on a regular basis.
- The presence of stray cats as well as rats should be decreased by preventing the overflow of solid waste containers, getting rid of wastes and cleaning regularly.
- Periodical checking and maintenance of the plumbing system for both the drinking water pipes and taps and the sewerage system should be performed in order to prevent leakage and treat cracks.
- Special care for the hospital drinking water with regular checking of its quality, chemically and biologically, is mandatory.
- As regards wastewater, the discharge from the MRIH can contain large amounts of chemicals and microbial agents. All or some of these chemicals may need special pretreatment processes before the wastewater is discharged to the municipal sewers.
- Segregation of solid waste should be practiced in all hospital sites, and the International Infectious Substance Symbol should be used for labeling the infectious wastes, which should be collected in strong, leak-proof yellow plastic bags.

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الظروف الصحية لمستشفى معهد البحوث الطبية بالإسكندرية

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المستخلص. تم في هذه الدراسة فحص كافة الظروف الصحية في مستشفى معهد البحوث الطبية، لإلقاء الضوء على الوضع الصحي والبيئي بالمستشفى، ولتحقيق هذا الغرض تم القيام بالدراسة على مدار عام كامل، بدأ في خريف عام ٢٠٠٢م وانتهى في صيف عام ٢٠٠٣م، وقد تم دراسة خصائص موقع مستشفى معهد البحوث الطبية الأساسية، ومصادر الأذى والإزعاج المحتملة حولها، عن طريق استمارة ملاحظة ورصد، أظهر فحص مواسير الشرب ونظام السباكة، أن هناك بعض التسريب من صنابير المياه بالحمامات وعنابر المرضى، مما قد يتسبب في سهولة الانزلاق على أرضيات الحمامات وعنابر المرضى، وخاصة في العنابر المجانية؛ كذلك فإن الفحص أظهر وجود بعض التشققات بمواسير الصرف الصحي، مما يتسبب في تسريب الماء الملوث، ونمو بعض الطحالب حول هذه المواسير، أما فيما يتعلق بنوعية مياه الشرب، فإن التحليل الكيميائي للكلور المتبقي، أظهر أن القيم تتراوح بين ٠,٠٢ و٠,٠٦ مجم/لتر لكل عينات المياه على مدار

العام، وبهذا تكون نسبة الكلور المتبقية في المياه تتفق مع الحـــدود المـــسموح بهـــا (٠,٠٢ و٠,٠٥مجـــم/لتـــر)، وأظهـــر الفحـــص الميكروبيولوجي لمياه الشرب غياب العد البكتيـــري فـــي معظـــم العينات من مختلف وحدات المستشفى، فيما عدا حجـــرة الجراحـــة حيث كان العد البكتيري ٢٠CFU/مل في الربيع والصيف، وإن كان لم يتعدّ الحد المسموح به من قبل منظمة الصحة العالمية والقوانين المـــصرية، وهـــو: ٥٠CFU/مـــل، كـــذلك أظهـــر الفحـــص الميكروبيولوجي لمياه الشرب، غياب الميكروبات المعوية المـــسببة للأمراض في كل عينات مياه الشرب على مـــدار العـــام. وفيمـــا يختص بالمخلفات الصلبة بالمستشفى، فقـــد أظهـــرت الدراســـة أن ٣٤,٣٪ من مخلفات المستشفى إكلينيكيـــة و٦٥,٧٪ منزليـــة، وأن معدل توليد المخلفات حوالي١,٢ كجم/مريض/يوم.