

International Journal of Research and Reviews in Pharmacy and Applied science

www.ijrrpas.com



COMPARISON OF ULTRASOUND MACHINES PROBLEMS IN DIFFERENT HOSPITAL'S DEPARTMENTS, A STUDY ON JORDANIAN MILITARY HOSPITALS

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ABSTRACT

Knowing the cause of any problem or failure is the major part of the solution. In this paper we will introduce the major causes of the ultrasound machines problems or failures in different hospitals departments as a part of the preventive maintenance plan, because from a technical point of view when you expect the type of any problem you will be ready for the solution and so you will minimize the down time period of the machine which can cost a lot in so many cases.

Keywords: Ultra sound Mechanics, Jordan, Military Hospital.

INTRODUCTION

In any hospital there is big range of medical devices varies in their functions which are made for, some of them are dedicated for some departments like infant incubators, operating tables, anesthesia machines, laboratory centrifuge, etc. and some of them are made to be used in different departments like patient monitors, sphygmomanometers, ultrasound machines, etc.

For those machines made to be used in different departments, the configuration of the machine itself varies to be suitable for the place that will work in. This means that those machines will be used by different physicians and technicians and so the types of failure will differ from one place to another.

In our case we will talk about ultrasound machine which is an imaging diagnostic machine that can be used in most of the hospital's departments and mainly in¹:

- 1- The radiology department.
- 2- The gynecology department.
- 3- The cardiology department.
- 4- The vascular department.
- 5- IVF laboratory.
- 6- Emergency department.
- 7- Out-patient clinics.

In those places the machines working environment varies and hence the failure and problem type and cause which means that different types of preventive maintenance must be conducted to keep the machines in a good working condition and that leads to:

- 1- Faster solution of the problem.
- 2- Minimal down time periods.
- 3- Minimal costs.
- 4- Minimal efforts.
- 5- Minimal spare parts orders.
- 6- Better performance of the machine itself.

In this paper we are trying to help in finding a good preventive maintenance plan and schedule for ultrasound machines which will save a lot of time and money.

CASE OF STUDY

In our study we referred to the maintenance calls, service reports and history cards in the institute of bio-medical technology database for the Jordanian military hospitals, the different environments of these hospitals gave us the needed variety, we noticed that these environments varies from dusty and

hot weather environment to cool and dust free environments and that was directly related to the types of failure and problems encountered during service jobs.

First of all, areas which have military hospitals in Jordan can be divided into three zones:

- 1- Northern zone, which has a cool (5-33°C temperature range) and dust free weather.
- 2- Med zone, which has a cool (5-35°C temperature range) and dusty weather.
- 3- Southern zone, which has a hot (10-42°C temperature range) and dusty weather.

And hence the ultrasound machines are very sensitive to heat and dust, it was obviously clear that the machines located in the southern zone suffered from frequent overheating errors and failures while the northern zone's machines suffered from different types of failures not related to overheating.

To clearly understand what was mentioned, we need to classify the causes of failures into three categories:

- 1- Misuse failures.
- 2- Environmental failures.
- 3- Aging-effect failures.

For the aging-effect failures it is not related to the people using the machine or the place where the machine is installed so it is not a part of our study. We tried to highlight the first two categories because they are directly related to medical stuff and department or hospital's location, and here is a look on each one the these two categories:

➤ Misuse failures:

These failures are directly related to the medical staff using the machine and from our study we found that the main causes of these failures are:

- Lack of knowledge about improper use of the machine.
- Breaking of some parts of the machine such as the scanning head due to Falling on the ground.
- Lack of cleaning for the different parts of the machine and the most important part is the scanning head which must be cleaned from the acoustic jell after each examination.
- Violence when dealing with the machine itself specially when moving it from place to another.

➤ Environmental failures:

These failures are directly related to the location and department where the machine is installed and from our study we found that the main causes of these failures are:

- Dust accumulation which causes the machine to overheat and leads to some electronic failures.
- Hot climate environment which obviously leads to electronic failures, and this factor can be caused by either a hot climate area or non-well ventilated working room or a crowded working room.

During our study on the different departments in King Hussien Medical city (KHMC) we noticed that every department has a unique pattern of failures and this can be shown in figure(1)² which shows the percentage of each failure cause from the total service calls in the last year:

Depart.	Failure	Misuse failures	Environmental failures
The radiology department		73%	27%
The gynecology department		54%	46%
The cardiology department		87%	13%
The vascular department		84%	16%
IVF laboratory		84%	16%
Emergency department		52%	48%
Out-patient clinics		55%	45%

Table: 1

RESULTS

From what was mentioned before we can say that the preventive maintenance can be conducted by means of two actions:

1. Keeping a cool and well ventilated environment for the machine starting from the examination room which must be big (not less than 9m² in area) and having an adequate cooling system to keep the room temperature lower than 23°C, then we have to keep the examination room not crowded hence the crowded rooms are usually saturated with water vapor and the condensing of that vapor will lead to multiple electronic failures in the machines, another important result is that from a technical point of view the machines that are suffering from a repeated environmental failures must have a frequent dusting preventive maintenance program for its filters to maintain them cool and in a good working condition. And these actions are necessary for:
 - Gynecology department.
 - Emergency department.
 - Out-patient clinics.

Nevertheless this action must be conducted on all of the departments because as we can see from figure (1) that all of them are having environmental failures but in different percentages and we gave the priority to those departments that had a high percentage of environmental failures.

2. Technical refreshing seminar programs to be held for the medical staff, the goal of these programs is to teach them the ideal and proper way of using and dealing with the machines, also the proper way of cleaning the scanning head from the acoustic jell after each examination and cleaning of the machine itself, and this will definitely reduce the misuse failures caused by a non-trained staff. Referring to our study data this action must be conducted necessarily on:
 - The radiology department.

- The cardiology department.
- The vascular department.
- IVF laboratory.

Nevertheless this program must be conducted on all of the departments because as we can see from figure(1) that all of them are suffering from a lack of proper use of the machines but in different percentages and we gave the priority to those departments that had a high percentage of misuse failures.

CONCLUSION

In this paper we took the king Hussien Medical city and all of the Military hospitals in Jordan as a case of study trying to help putting a good preventive maintenance plans for different departments in those hospitals, and we found that failures of the machines differs from one place to another some of them are caused by manmade factors and some are caused by environmental factors, and the way to deal with each kind of these failures is different.

We found when applying a good preventive maintenance plan for each department depending on this study that different failures reduced by different percentages as shown in figure (2)³:

Failure	percent.	Reduced by
Misuse failures		65%
Environmental failures		73%

Table: 2

Regarding to figure (2) the actions been taken reduced the down-time periods of the machines and the spare parts orders so the total cost of maintenance which is a very important factor in any hospital's economical plan. And again: **Knowing the cause of any problem or failure is the major part of the solution.**

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