

Medical Device Maintenance: Prolonging the Use of Medical Device

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ABSTRACT

Procurement and installation of medical device and equipment involves a huge amount of finance in healthcare setting. The timely inspection and maintenance of medical device is as important as its design and development. Timely performed preventive maintenance (PM) prolongs the operative life, reduces the maintenance cost and increases the efficacy of the device. Planned preventive maintenance includes the schedules for inspection and maintenance of device so that any problem can be identified earlier and risk associated with device failure can be minimized.

Keywords: Medical device; Preventive maintenance.

INTRODUCTION

Modern medical device have become an integral part of healthcare and with time they have evolved a lot. From the use of simple magnifying microscope and normal stethoscopes, the medical technology has grown to a high end digital microscope and digital stethoscope that can even record Electrocardiograph (ECG). Such sophisticated devices comprises of a lot of components compactly organized to make them portable. Even a slight mishandling can lead to permanent damage of the device. So, proper training to the user before operating and planned/ timely maintenance schedule are to be made.¹ Biomedical engineering departments in hospitals are liable for developing and regulating a Medical Equipment Management Program to ensure that medical devices are accurate and reliable. They need to work out for the timely maintenance of the medical device and report any issues to the hospital administration.

Such act has been achieved through daily inspection and check of the device by hospital's engineer or through annual maintenance contract with the distributor.² Regular calibration and check-up of the device under PM has allowed the doctors and nurses to get the accurate reading and has enhanced the diagnostic parameters.³ Medical equipment accounts for around 40% to 50% of total expenses in a tertiary hospital setting; nevertheless, even if the technology is cutting-edge at the time of purchase, it faces the prospect of certain obsolescence within 6-7 years of its installation. Inspection, preventive maintenance, and calibration/testing of medical equipment should be performed continuously to keep up with current technological developments and the increasing expectations of hospital.⁴

Maintenance strategies

Various techniques and management strategies for the effective maintenance of the medical device has been proposed and implemented worldwide. In the past the maintenance used to be carried out once the damage has been identified or the device had problem, but with growing development in technology, the devices are checked timely and problems are detected and rectified before such problem led to major malfunction.⁵ The chart below demonstrates the generation of maintenance services carried out for a medical device.

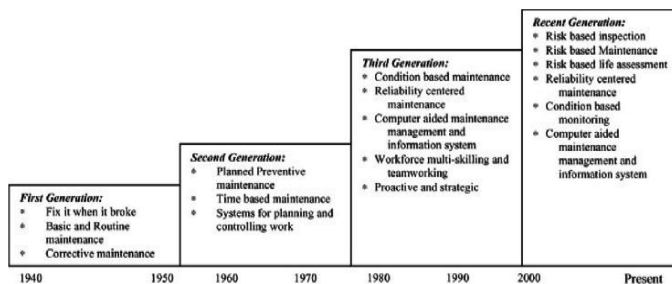


Figure 1: Technique of maintenance of medical device

Among various method of preventive maintenance, one of the methods is reliability centred maintenance (RCM). RCM relies on condition monitoring, analysis of failure causes and investigation of operating needs and priorities. RCM lists out the major components in equipment, which may possibly lead to device failure or financial loss and initiates maintenance programs for these components.⁶ Another way of maintenance is condition based maintenance (CBM) which was introduced to balance dual aspect of maintenance preventive as well as corrective. In CBM engineer, observes and forecasts real time status of machines whereas in RCM the failure causes over a period of time is noted and initiates maintenance programmes to increase the up time of these equipment. CBM increases productivity, accuracy, usefulness and safety of the machinery systems. In CBM, machines are continuously monitored by calibrators and sensors to detect failure in real-time.⁷ Wang and Levenson proposed a noble evaluation technique of the function parameter and named it mission criticality, which they defined as the “equipment role or importance within the organisation’s mission”. Later they proposed a more explicit maintenance approach that uses patient risk-mission criticality as a classification method and a maintenance-strategy selection. According to Wang, the mean time of device failure is to be noted and ideally PM should be performed at time intervals just below the mean-time-between-failure (MTBF), as this would allow one to minimise resources while preventing the majority of failures.⁸ In most of the cases, the device can be repaired within

the hospital itself whereas some issues are not repairable and has to be transferred to the respective company for repair. Taghipour et al. considered a repairable system with components subject to hard and soft failures; soft failures are only rectified at periodic inspections and are fixed with minimal repairs. Such rectification of components within the time of soft failure can prevent hard failure in future prolonging the life and health of medical device.⁹ There might not be the availability of biomedical engineer at hospital at every time. When a hospital lacks the technical manpower or specialized assets needed for the maintenance of its medical technology, maintenance can also be outsourced. While outsourcing has grown in popularity, there are higher chances of being fooled. Healthcare institutions lacking the capacity to deal with these issues may face significantly higher costs. Probability of fraud and change of unwanted parts and components, use of unauthorized products can cause more financial loss to the hospitals, if they lack proper technical manpower.

CONCLUSION

Effective maintenance management of medical devices increases the efficiency and productivity of resources within healthcare setup. This allows patients to access medical equipment that can provide an accurate diagnosis, effective treatment, or appropriate rehabilitation. With ever growing complexity of medical device, the risk of failure of device at critical moment is inevitable. Although some risk factors are detectable prior to failure and some of them are instantaneous. With the planned preventive maintenance techniques such as RCM and CBM, such risk can be minimized, establish reliable and accurate reading and prolong the life cycle of the machine.

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