



## AN OBSERVATIONAL STUDY OF THE BIOMEDICAL ENGINEERING DEPARTMENT AT A TERTIARY CARE TEACHING HOSPITAL

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### ABSTRACT

**Background:** Biomedical engineering may be defined as studying and applying engineering principles and techniques to the medical field. The goal is to provide safe, calibrated, operational equipment to deliver the best healthcare. **Aim/Objective:** This article is aimed to study the function of the Biomedical Engineering Department at Tertiary Care Teaching Hospital. **Methods:** The study is descriptive and observational. The observational data was collected from January 2020 to June 2020. Focused group discussions with the stakeholders involved in the biomedical engineering department were noted. The descriptive data were analysed with documented evidence from various records. **Results:** The Biomedical engineering department has three rooms on the ground floor. A total of 09 members are working as staff. The following findings were noted on observation: 1. Procurement of the equipment, 2. Maintenance of the equipment, 3. Service of the equipment 4. Inspection of biomedical equipment, 5. Equipment Condemnation, 6. Record maintenance, 7. Complaint system. **Discussion:** The Biomedical Engineering department is vital and manages all the medical equipment in the hospital. The entire biomedical engineering proactively collaborates with other healthcare staff in planning and purchasing equipment, with prime responsibility for maintenance and modification of equipment. In our study, 96% of doctors know the functions, and 82% responded as good about the biomedical engineering department's efficiency. Moreover, 96% of nurses are aware of the functions, and 76% of the nurses admitted that the biomedical engineering department was attending to the calls for the equipment breakdown. In the current study, a well-established equipment procurement policy is in place that specifies the authority to make procurement decisions as per the cost level of equipment, including vendor selection. In the present study, the records viz., master list, work order, preventive maintenance plan (PMP) schedule, history card, complaints register, equipment logbook, AMC contract register, service reports, equipment manual, CMC register, all Breakdown calls to register and budgeting register was maintained. The robust complaint cell is present in the hospital, for which the department manager is responsible. **Conclusion:** This study concluded that the Biomedical Engineering department manages all the medical equipment. The study also concluded that the biomedical engineering team provides safe, calibrated, operational equipment for delivering the best health care. The department is responsible for Planning and procurement, repair, maintenance, work orders, equipment inventory, preventive maintenance schedule, documentation, and equipment monitoring.

**KEYWORDS :** Biomedical Engineering, Equipment maintenance, Condemnation, equipment management.

### INTRODUCTION

Biomedical engineering is a multidisciplinary field that integrates principles from engineering, physical sciences, mathematics, and informatics to study biology and medicine, aiming to improve human health and quality of life. <sup>(1)</sup> technology, materials, and knowledge innovations mean that tomorrow's breakthroughs can barely be conceived today. Revolutionary advances in medical imaging and diagnostics are changing how medicine is practised. New medical devices arising in biomedical engineering research laboratories worldwide have wholly altered how disease and trauma are dealt with by physicians, extending the quality and length of human life. In the hospital setting, equipment management is the function of the Biomedical engineering department. <sup>(2)</sup> The Biomedical Engineer has become the equipment manager, helping health providers acquire technology ensuring its safe, continued efficient utilisation. A skilled biomedical engineer's team typically involves installing biomedical equipment, adjusting, calibration, performance verification and certifications, management and performance of planned preventive maintenance, utility certification, creation of the computerised database, incoming inspection of types of equipment, equipment condemnation process, equipment risk management, technical documentation, and analysis. Biomedical services are evident and essential throughout healthcare, from diagnosis to treatment and recovery and of any size. <sup>(3)</sup> As we move into the next century, there is a need for proper integration of the medical field and engineering. This article is aimed to study the function of the Biomedical Engineering Department at Tertiary Care Teaching Hospital.

### Methodology

The current study is a descriptive and observational study to assess the functions of the biomedical engineering department of a 1430-bed tertiary care teaching hospital in South India. The observational data were collected from January 2020 to June 2020 (six months) from direct observation of day-to-day activities and retrospective documents. A Focused group discussion (FGD) with the stakeholders who were involved and utilising the biomedical engineering department, i.e., clinicians, staff nurses, and biomedical engineering staff, was also arranged, and findings were noted. The descriptive data were analysed, scrutinised, and verified with documented evidence

from various records. This narrative study gives the complete picture of the functioning of the Biomedical engineering department.

### OBSERVATIONS/RESULTS

The Biomedical Engineering department is located on the ground floor of the General Hospital and consists of three rooms: reception, a Manager room, and a workshop. The reception area receives the equipment and incorporates the workshop used for repairing equipment. A total of 09 members are working as staff in the biomedical engineering department in three shifts.

On observation, the Biomedical Engineering department was involved in various hospital functions. The observation findings are as follows-

- 1. Procurement of the Equipment:** For any new equipment purchase, requisition is raised and forwarded to the purchase committee. As per the guidelines, the equipment is procured. The biomedical engineer inspects the equipment after receiving it. All the specifications of the equipment are entered into the log book.
- 2. Equipment Maintenance:** The Department of Biomedical Engineering follows annual maintenance contracts, comprehensive maintenance contracts and preventive periodic maintenance. The details of the equipment, like ID number, company name, and tenure of the contract entered into the AMC, CMC and PPM registers
- 3. Service of the Equipment:** Quotations will be raised for equipment not covered under the AMC and PPM maintenance. Any equipment which requires repair outside of the biomedical engineering department workshop requisition is raised and forwarded to the purchase committee by the biomedical engineer. The equipment is transported through the gate pass and signed by the biomedical manager and security officer.
- 4. Inspection of Biomedical Equipment:** The Biomedical Engineer performs necessary biomedical engineering inspection of equipment, namely, Visual Inspection, Performance Tests, Calibration, Lubrication, etc. The biomedical engineer will perform the performance tests. If any defect is found during the test, it will be notified to the company, and equipment will be withdrawn until the troubleshooting is corrected.
- 5. Equipment Condemnation:** The institute may opt for

condemnation depending upon the condition of the equipment by the condemnation policy.

6. **Records Maintenance:** The Biomedical Engineering department in the current study setting maintains the following twelve records,
  - i. Master List
  - ii. Work Order
  - iii. Preventive Maintenance Plan (PMP) schedule
  - iv. History card
  - v. Complaints Register
  - vi. Equipment Logbook
  - vii. AMC Contract Register
  - viii. Service Reports
  - ix. Equipment Manual
  - x. CMC register
  - xi. All Breakdown calls to register.
  - xii. Budgeting register
7. **Complaint System:** All the complaints received are in the form of E-complaint. If there is any troubleshooting in the biomedical equipment, the user department will raise the E-ticket through the online system. The biomedical manager will receive the E-complaint ticket. Then, according to the type of complaint, the biomedical Department will follow up on the problem.

## DISCUSSION

The Biomedical Engineering department is crucial and supervises all the medical equipment in the hospital. In the present study, an insight attempt was made to study the biomedical engineering department's function. The Department's role was to provide timely, knowledgeable, and quality service to healthcare professionals. Other functions include planning, installation, calibration, technical documentation, performance verification, and certification of biomedical equipment.

The entire biomedical engineering proactively collaborates with other healthcare staff in planning and purchasing equipment, with prime responsibility for maintenance and modification of equipment. In our study, 96% of doctors know the functions, and 82% responded as good about the biomedical engineering department's efficiency. Moreover, 96% of nurses are aware of the functions, and 76% of them admitted that the biomedical engineering department attended the calls for the breakdown of equipment. The results signify the efficient functioning and management of equipment by the biomedical engineering department.

To face the challenging competitive environment and complex healthcare system, all hospitals should take the appropriate operational activities of medical devices such as purchase, contract, repair, and maintenance (Andreas et al., 2009)<sup>(4)</sup> In the current study, a well-established equipment procurement policy is in place that specifies the authority of making procurement decisions, as per the cost level of equipment, including vendor selection; the decision of procuring low-cost equipment can be taken at the department level, while a committee can only decide on procuring high-cost equipment. The indicative level of low, medium and high costs is defined. The equipment selection committee (Purchase Committee) considers equipment selection, purchase, and renting (beyond the specified equipment cost). This committee also decides on technology upgrades. The committee consists of a representative from the clinical Department where the equipment will be used (doctor, nurse, or technician who will be using the equipment), a representative from the administration department (CEO, Director), finance department, and the biomedical engineering department.

Our studies corroborate the procurement policies studied by Aruna M et al. (2018) at Al-Garhoud Private Hospital's Biomedical Engineering Department, UAE. In effect, the practice of an efficient information system will effectually stimulate managing performance. This approach's drive has outlined efficient equipment management that affords the safe and steadfast procurement and operation of medical equipment used to treat patients.<sup>(5)</sup>

Hospital and clinical administrators expect a return on investment that meets accounting guidelines and financial pressures (David & Jahnke, 2004), and maintenance, repair, and servicing play a significant role in accounts for expenditure<sup>(6)</sup>. Hence, appropriate deployment of healthcare technology improves healthcare delivery (Sprague, 1988)<sup>(7)</sup>. As systems complexity and integration continue to increase, now is the time to demonstrate that the required competencies contribute to

desired outcomes (Yadin, 2008)<sup>(8)</sup>. Managing medical equipment efficiently and adequately ensures that healthcare services are presented securely and successfully. For this purpose, creating inventory/records for managing all sorts of activities is essential. Inventory is a working document inspected and updated regularly to provide precise information about the medical asset. In the present study, the records viz., master list, work order, preventive maintenance plan (PMP) schedule, history card, complaints register, equipment logbook, AMC contract register, service reports, equipment manual, CMC register, all breakdown calls to register and budgeting register was maintained.

On the other hand, more extensive facilities must keep their inventory well updated, as it is often the case that they have thousands of medical equipment to be kept track of and maintained. An equipment log to record events associated with a piece of equipment can be created using a Computerized Maintenance Management System (CMMS)<sup>(9)</sup>. The hospital's robust complaint cell is present, which is the biomedical engineer responsible for orienting new staff members. The staff trained with necessary operating and safety procedures, emergency procedures, maintenance, and reporting methods for equipment problems, failures, and user errors, similar to Saramma et al., 2021<sup>(10)</sup>.

## CONCLUSION

In this study, we concluded that the Biomedical Engineering department oversees all the medical equipment in the study setting. The Biomedical Engineering team assists the entire hospital in acquiring technology, ensuring its safe, continued efficient utilisation, maintenance, and quality. The department plays a crucial role in safe and effective healthcare technology accomplishment. The study also concluded that the biomedical engineering team is responsible for Planning and procurement, repair, maintenance, work orders, equipment inventory, and documentation. The following recommendations were suggested for efficient department functioning for better patient service.

1. The workshop space of the biomedical engineering department should be increased.
2. Asset coding for all the biomedical equipment of the hospital.

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