

Chapter 7. Clinical Engineering

Some electrosurgery generators and a capacitive plate.

Smith D N

Department of Medical Physics and Medical Engineering, Western General Hospital, Edinburgh, EH4 2XU.

Introduction Large area non-adhesive capacitive return plates apparently offer clinical and economic advantages over conducting adhesive gel plates¹. Variable performance from different models of generator was reported when using capacitive plates. The staff received conflicting advice from the makers of the equipment and the suppliers of the return plates. Was it safe to use them with these generators? The generators incorporated return electrode monitoring requiring the use of a split plate. The capacitive plate prevents this safety system from operation. There is no analogous system for ensuring that non-contact plates have adequate capacitive coupling.

Method The outputs of different generators were measured under a variety of conditions of simulated load with and without a capacitive connection. The capacitive connection was simulated by using two return plates face to face in the circuit between generator and tester. This capacitance was varied by adding layers of paper between the plates and by folding back the upper plate to reduce the area of overlap. These actions reduce the capacitance to the patient and increase the total impedance in the circuit.

Results Wide variations were found in the ratio of energy delivered to preset energy for the different models of Generator.

Conclusions Contact area with the patient must be maximised and the layers between the patient and the plate minimised. Generators that do not

compensate the output for load impedance will give a poor result when the patient circuit has a low resistance but the plate impedance is high. Generators that automatically adjust output to compensate for circuit impedance may produce an increased risk of alternative path burns.

Reference

[1] Megadyne Mega 2000 Return Electrode *Health Devices* 2000 Dec: 29(12), 445-460.

Evidence Based PPM Planning

Price R

Department of Medical Physics and Engineering, Leeds Teaching Hospitals, Leeds, LS1 3EX

Introduction The counsel of caution suggests that Clinical Engineering departments should always service medical equipment according to the manufacturer's schedules. However, it is not clear that manufacturers' schedules are generally evidence based. If departments are carrying out too much maintenance, operational costs will be too high; too little and they incur the human and financial costs of equipment failures and clinical incidents.

To identify the balance we must examine the work we do and prioritise activity to the areas where it will have most impact – those which present the greatest risk. Quantifying the risk is not easy. The risk presented by any given item of equipment depends on its intended purpose, its clinical setting, the skill and care of its users, its design and its history among other variables. This has led to the proposal of a range of schemes for the evaluation of risk level and setting of service intervals. Clinical engineering departments are hampered by the lack of an agreed approach.

Chapter 7. Clinical Engineering

Proposal We propose that a risk evaluation scheme of general application should have the following properties:

- It must be robust and soundly based
- It must be easily calculable from parameters that are readily available
- Ideally both service intervals and service content should be specified
- The risk associated with the use of the equipment should be adequately controlled

Conclusion This paper proposes a new evidence based framework, incorporating information from our extensive equipment history archive. Assessments of sample equipment types are carried out, and the consequences for service intervals and activity assessed in theory and in practice.

Acknowledgement The author acknowledges the important contributions to this work of all the technical staff in Leeds Teaching Hospitals' Clinical Engineering department.

Selecting the right partner: The crucial step in medical device management.

Amoore J N¹, Emili D² and Ingram P³

¹ Dept of Medical Physics, Lothian University Hospitals NHS Trust, Edinburgh, EH3 9YW, Scotland

² ESIL, Université de la Méditerranée (Aix Marseille II)

³ Dept of Medical Physics and Dept of Nursing, Royal Infirmary of Edinburgh, Edinburgh, EH3 9YW,

Introduction Careful medical device selection is crucial to effective healthcare delivery. Poor selection leads to high device and user fault rates, with implications for clinical risk management. For example ITU infusion device failure rate increased from 0.98 faults per device year to 2.39 when an old model was replaced; within 3 years the replacement

was withdrawn and its successor's failure rate (over 2.5 years) dropped to 0.59. We focus on user evaluation, attempting to ensure objectivity in an inherently subjective process.

Methods and Materials A questionnaire divided into "Operational Aspects", "Controls" and "Physical aspects" quantified clinical staff preferences with tick boxes graded from "Very good" to "Very poor". An opportunity for free text and a question asking if the user would personally recommend purchase were included. Defibrillator and infusion pump selection are discussed, widely used devices whose particular training needs preclude widespread evaluation. Medical Physics and Clinical Skills Co-ordinators pre-selected devices for evaluation. Defibrillator evaluation was confined to areas with frequent defibrillations and where staff could be trained – CCU cardioversion clinic and Accident and Emergency. Selected wards evaluated infusion devices.

Results The scored questionnaires were graphically displayed, revealing user perceptions. Different products scored better for particular aspects, but overall preferences emerged. Determining aspects included battery capacity and paddle controls (defibrillators) and weight, size, and ease of use - simple and instinctive controls, clear displays. Asking staff to personally recommend purchase revealed definitive preferences.

Discussion User errors contribute to "device failures", necessitating careful user evaluations and vendor independence. Selection involves standardisation but not exclusivity, recognising that the partner chosen must be acceptable to a wide range of users, with goals of 1 defibrillator but 2 or 3 infusion device makes. Objective user evaluation, avoiding infatuation and recognising financial constraints, supports effective healthcare.

Chapter 7. Clinical Engineering

Developing The Traditional Role Of The Clinical Engineer Into A Multi-Skilled Holistic Engineering Function: Breaking The Mould.

Grainger P B, Larkin T, McCullagh J, Mahady J, Kinsella R and Rogan D

Medical Physics and Clinical Engineering Department (MPCE), AMNCH, Tallaght, Dublin 24, Ireland.

The MPCE department at AMNCH, opened with the new Tallaght Hospital in 1998. At this time many crucial decisions had to be made. MPCE staff were an integral part of the AMNCH Equipping and Commissioning process (ECP). Demands on resources were extreme.

Significant choices for the department had to be made i.e. commit totally to the ECP, partially engage or totally outsource this work and concentrate solely on developing MPCE.

Total engagement was the preferred option. Fortunately this coincided with the requirements of the Department of Health and the hospital. The brief of the MPCE staff group was broadened. Staff managed significant aspects of the ECP. This enabled staff to develop significant links with medical, nursing, paramedical and managerial staff at all levels.

Through this project the profile of Clinical Engineering has been significantly raised. This is manifested by continued involvement in hospital hierarchical activity and associated committees and development of many new opportunities.

Clinical Engineering staff have developed new bloodlines by becoming an integral component of most clinical support activities. Through membership of multidisciplinary teams in ITU, Theatre, Dialysis and Endoscopy significant contributions in the areas of research, education and clinical decision making have been made.

Today the MPBE department at AMNCH is comprised of a multidisciplinary high profile team. The role of the Clinical Engineer has developed into a multi-skilled holistic Clinical Engineering function, which contributes significantly to patient care. A template has been developed and in addition to presenting how this was achieved we encourage other departments to follow suit.

The Role of the Clinical Engineer and Engineering Technologist

Cook D A

Royal Berkshire and Battle Hospitals NHS Trust, Reading

Abstract Two years ago, the Clinical Engineering SIG annual meeting carried the title: "What is Clinical Engineering?" What arose from this meeting was that there is much debate over the exact role of Clinical Engineers and differences between perceptions of Clinical Engineering in different countries. Further, the relationship of Clinical Engineering to other areas of engineering in the field of medicine and biology is also subject to personal interpretation. One may be tempted to ask why there is a lack of clarity over roles, and whether the IPPEM wishes to see a clearer focus. The American College of Clinical Engineering have defined their view of the role of the Clinical Engineer: "A clinical engineer is a professional who supports and advances patient care by applying engineering and managerial skills to healthcare technology".

However it is certainly true that the detail of Clinical Engineering is shaped according to national initiatives and pressures. Over the past three years, there have been enormous shifts in attention from public and governmental levels that have had major impacts upon the Clinical Engineering profession in the UK. In

Chapter 7. Clinical Engineering

1999 the National Audit Office report on management of medical equipment in NHS Trusts drove a demand for efficiency in Clinical Engineering Departments. Controls Assurance for Medical Device Management has placed safety and effectiveness of all aspects of the service under the microscope from the NHS Trust Boards. Recently a concerted assault from the private sector has seen several Trust hospitals decide to outsource their Clinical Engineering service to Multi-Service Vendor contractors. The Introduction of Statutory registration for Clinical Scientists and a voluntary register for Technologists has changed the emphasis in terms of training and professional development requirements. "Making the Change- a strategy for healthcare science " launched last year has created the likelihood of a single employment spine for scientists and engineers in healthcare, and with it the desire to develop National Occupational Standards for the professions.

This presentation will endeavour to take stock of where the engineering professions in medicine are today, and present some updates on key initiatives in which IPEM is involved to assist in clarifying the roles of the profession and in providing guidance on how to respond to the challenging issues of the day.

Can't Sit! Won't Sit (The Paediatric DMSA Imaging Chair)

Beckwith R

Regional Medical Physics Department, Royal Victoria Infirmary, Newcastle upon Tyne, NE1 4LP

Introduction There can be problems when conducting DMSA imaging in small children up. Motion artefacts are the biggest degrading factor. Staff are frequently faced with physically holding the child whilst collecting image data in order to maximise picture quality. This is not only stressful to the child

but staff are invariably subjected to restraining fractious children in uncomfortable and physically demanding positions.

Method A prototype-imaging chair was designed and manufactured overcoming the above problems. The new chair, suitable for babies and children up to four years of age, adopts a slightly tilted sitting position similar to that of a child's car seat. The open back design allows the child to be positioned against the camera for optimum count rates, oblique images are achieved by repositioning the chair rather than the child. A three-point safety harness secures the child's torso whilst allowing the limbs freedom of movement.

Results The ergonomics are greatly improved for all concerned. The need for physical restraint, often subjecting staff to bad posture, is greatly reduced. The child is safe and secure whilst retaining a sense of freedom. With improved child compliance the time taken to complete a scan is reduced with fewer restarts due to fuzzy images. Picture quality is unimpaired with no loss of resolution or counts.

Conclusion The chair has been in constant use for the last year and has proved to be a great success and further developments are likely. It is a popular piece of equipment with nuclear medicine staff. The children are more co-operative making the scanning process easier.