

Middle Articles

HOSPITAL TOPICS

Organization of a Coronary Care Unit in a General Hospital

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The current interest in intensive care units for patients with myocardial infarction centres on the fact that many die not of extensive myocardial damage but of potentially reversible arrhythmias. In recent years techniques of cardiac resuscitation have advanced considerably. Most nursing and medical staff are familiar with external cardiac massage and artificial ventilation, and many hospitals are in possession of some form of external defibrillator. The purpose of an intensive care area is simply to bring all patients at risk together in an adequately equipped ward unit and to provide the optimum facilities for early detection and treatment of complications after myocardial infarction. If the coronary care unit is to make any impact on the national mortality from myocardial infarction it must be adapted to the needs, and means, of the busy general hospital. The requirements of such a unit differ from those of an ordinary intensive care unit and do not appear to have been discussed in relation to the district hospital.

The General Hospital, Birmingham, admits approximately 250 patients a year with acute myocardial infarction. The coronary care unit must, however, be prepared to admit at least 300 patients a year, because many are admitted on suspicion of having sustained myocardial infarction and the diagnosis is subsequently not proved. A coronary care unit was opened in October 1966, and this paper discusses some of the problems of organizing and equipping such a unit in a general hospital.

Site and Structure

It is important for the coronary care unit to be as self-contained as possible; an independent unit in terms of both staff and any ancillary services which may be required urgently—for example, radiological screening and acid-base determinations. To nurse patients with myocardial infarction within an ordinary intensive care unit is unsatisfactory. They require a calm atmosphere and reassurance and would suffer considerable anxiety in such surroundings. However, it would seem that there may be a great advantage, in terms of sharing equipment and skilled staff, in the juxtaposition of these two forms of unit. We decided against partitioning off a section of a general ward as a coronary care unit. It is difficult to maintain constant vigilance on one group of patients in a busy ward, and, though complex electronic monitoring equipment may to some extent replace the nurse's powers of observation, warning signals are of no avail in the absence of staff immediately free to render assistance. In addition, we have found that when patients are singled out for close observation in a general ward, particularly when attached to an oscilloscope, they feel insecure and apprehensive. Conversely, in a small ward where such

techniques of observation are seen to be applied universally the individual does not feel that he is particularly at risk.

A ward day-room was finally selected. It measures 560 sq. ft. (52 sq. m.) and accommodates five beds arranged radially. A larger area would confer greater freedom of access to the beds, particularly after an arrest when several staff and bulky equipment surround the patient, and would allow construction of cubicles with rigid partitions. There is, however, then some risk of losing the intimate contact with the patient which a small open ward confers, and monitoring equipment needs to be more elaborate. At present beds can be partitioned off with curtains, and one recessed area is set aside primarily as a resuscitative area, though resuscitation may be carried out on any of the five beds.

Sphygmomanometers are wall-mounted behind each bed beside a notice-board for the display of blood pressure charts and other clinical data. Oxygen is piped to the ward from the main hospital supply. Piped suction is not available and a portable sucker is stored in the unit. A liberal supply of power points is vital in view of the amount of electrically powered equipment. Some thought needs to be given to the placing of power points and cable lengths in order that the equipment is available to all parts of the unit.

The nursing station is simply a desk where notes may be written and nursing instructions given. There is no sister's office, so that the nurses are constantly in the ward. At night a nurse sitting at the desk may see all five patients and their attendant oscilloscopes.

The position of the coronary care unit within the hospital is of considerable practical importance. The unit requires to be as near as possible to its main source of patients—the casualty department—and to its main area of patient discharge, the male general medical wards. The General Hospital coronary care unit is well placed between the two principal male medical wards but at some distance from the casualty department. This is a disadvantage, for we play a smaller part than we would like in the initial resuscitation of the patient with a complicated myocardial infarction on his arrival in that department. In addition, the risk of cardiac arrest occurring in transit from casualty to the coronary care unit is not negligible. However, our current site facilitates good working relations with the wards to which we discharge patients and from which they occasionally return.

Apparatus and Equipment

Beds.—It is clearly desirable to avoid resuscitation on the floor of such a small ward unit. We have therefore adapted the ordinary hospital beds to allow external cardiac massage to be effectively performed without moving the patient to the floor.

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Beds are fitted with braked castors for stability during resuscitation and $\frac{1}{2}$ -in. (1.3-cm.) boards are permanently placed across the upper half of the bed frame. When propped upright with pillows the patient is unaware of the underlying boards. A 3-in. (7.5-cm.) polyethylene mattress is normally comfortable for the patients, but allows external cardiac massage to be performed effectively. The head of each bed has been sawn through at the uprights above the level of the spring frame and an obturator has been inserted into both upper sections. The head of the bed is then easily detached to allow tracheal intubation.

When transvenous cardiac pacemaking is indicated this procedure is carried out within the unit. One bed has been further adapted for this purpose. In order to permit the introduction of an x-ray source beneath the bed the legs have been lengthened by 3 in. (7.5 cm.). All metal springs have been removed and a 2-in. (5-cm.) radiotranslucent polyethylene mattress is supported by $\frac{1}{2}$ in. (1.3 cm.) of plywood mounted on the bed frame. Satisfactory radiological screening may be obtained in this way and the bed is comfortable enough to lie on. The position of the pacemaker catheter tip may be checked if necessary. The walls, floor, and ceiling of the unit are sufficiently dense to eliminate the need for further protective screening around the unit for the amount of radiation involved. The swing doors leading to the coronary care unit have been lined with 1 mm. of lead.

Display and Monitoring Equipment

A wide range of electronic equipment is currently available to any type of intensive care unit. Some of this seems to be unnecessarily complex for our purpose—for example, monitoring body temperature and respiratory rate is of little value in the coronary care unit. We have come to use the oscilloscope simply as a display apparatus, seldom using the monitoring and alarm systems. This is possible in a fairly small unit when nurses have been taught some elementary electrocardiography. Initially the nursing staff were asked to perform routine tasks—for example, counting the frequency of ventricular extrasystoles for one minute in the hour. This in itself was of little value but served to draw attention to the oscilloscope. Interest was further stimulated by a collection of common electrocardiographic abnormalities, including infarction patterns and arrhythmias. As a result the nursing staff have become extremely skilled in the detection of arrhythmias. The provision of a simple single-channel recorder enables the nurse to make a permanent recording of any arrhythmia direct from the oscilloscope.

Most warning systems are activated by a change in heart rate outside a preset range. A nurse may detect additional abnormalities—for example, the early stages of atrioventricular block or an alteration in frequency or form of ventricular extrasystoles. In addition, as indicated by Thomas (1967), mechanical cardiac arrest may occur in the absence of change in the electrocardiogram so that direct observation of the patient remains of primary importance.

Patients do not resent the physical attachment to an oscilloscope provided that it does not entail conventional leads, which not only hamper the patient's movement but make any nursing procedure difficult. We have elected to place the limb leads on the left upper arm with a single exploring electrode on the anterior chest wall, thus leaving the right arm and both legs free. Other similar electrode arrangements have been described (Fluck *et al.*, 1967). Some form of small lightweight adhesive electrodes are best for this purpose.

The floor is kept as free as possible from unnecessary equipment, and for this reason we arrange oscilloscopes on a shelf behind the patient or on a small bedside stand. Probably wall rails for all equipment provide the ideal solution.

Apparatus is available for measurement and recording of intravascular pressures and cardiac output, but this is probably

not necessary for practical purposes. The central venous pressure can always be measured by a simple water manometer via a polyethylene catheter advanced from the arm into the right atrium.

Radiological and Resuscitative Equipment

Although routine diagnostic radiology may be performed in the usual way it is advisable for the coronary care unit to be independent of the radiology department in the matter of screening. The rapid introduction of a cardiac pacemaker catheter into the heart by the transvenous route may be one of the most valuable contributions to the care of the patient. It is preferable to undertake this task in the unit and to avoid removal to another part of the hospital building which involves the patient in additional risk and delay. A portable image intensifier with closed-circuit television enables this to be performed within the coronary care unit and avoids the necessity of darkening the whole unit while screening.

The coronary care unit is equipped with a D.C. defibrillator and adequate apparatus for artificial ventilation—for example, oropharyngeal airways, self-inflating ventilating bag, laryngoscope with a wide range of cuffed endotracheal tubes, etc. The emergency drug cupboard is portable and contains all necessary resuscitative drugs, including 100-ml. infusion bottles of 8.6% sodium bicarbonate which are freshly dispensed by the pharmaceutical laboratory. Each piece of equipment has its own set position in the unit; this is important for speed of access in an emergency. An annexe of the unit contains blood-gas analysis apparatus for the rapid determination of arterial pH during resuscitation.

Electrical Hazards

The accumulation of electrical equipment poses certain hazards to the patient. Voltage build-up may easily occur on many forms of equipment, including cardiac monitoring apparatus. Normally it is unlikely that serious harm will result, since the high resistance of the patient's own tissues will prevent flow of current through the myocardium. However, the patient with a low resistance conduction line to the heart—for example, an indwelling cardiac pacemaker catheter or an intracardiac E.C.G. lead—is at considerable risk, as only a slight current (around 200 microamps) requires to flow through the myocardium to produce ventricular fibrillation. Though the pacemaker unit is screened from the A.C. mains, fatal voltage may still be applied to the myocardium unless all bare metal electrode attachments of the catheter are carefully insulated. All apparatus should be carefully and regularly checked for voltage build-up by a technique similar to that described by Whalen and Starmer (1967).

Staff

The coronary care unit provides a hospital service, and all patients suspected of having suffered a myocardial infarction are admitted to the unit under the overall care of their own consultant physician. One consultant physician and a senior registrar advise on the management of all patients within the coronary care unit, but the registrar and house-physician admitting the patient continue to look after him throughout his stay in hospital. These arrangements have the advantage of offering all junior staff experience in this work, and of providing a continuity of patient-care throughout the admission. The physician and senior registrar permanently attached to the coronary care unit provide uniformity of patient-care.

The nursing staff—one sister and seven staff nurses—are employed entirely in the coronary care unit. The observations required of the nurses and the speed with which they must

reach decisions and act upon them make frequent change of nurses quite impracticable. Student nurses not infrequently spend short periods of time within the unit to gain some insight into its techniques and work, but an experienced member of the staff is always present. The nursing staff are often able to guide relatively inexperienced doctors in the identification and management of certain arrhythmias. In addition they explain to the patient and his relatives the nature and purpose of the equipment with which he comes into contact.

Duration of Patient's Admission

Most patients, male and female, spend three to four days in the unit, and, if they pursue an uncomplicated course, are then transferred to the general ward. Patients with serious arrhythmias, hypotension, or cardiac failure remain longer. Since it is our policy in the treatment of complete heart block to leave a catheter pacemaker in situ for three weeks in spite of a return to sinus rhythm, these patients remain with us for the whole of this period.

We encourage only short visits from close relatives for the first few days. The kitchen of the general ward to which the coronary care unit is attached supplies all meals. As the diet is predominantly fluid and extremely light for the first three days after admission the kitchen facilities required are not demanding.

Practical Experience

One is entitled to ask what sort of return is likely to be seen for this considerable outlay in money and staff. The following is not intended to be a detailed analysis of our work but a brief summary which gives some idea of what may be expected.

In the first six months of full operation, 144 patients were

admitted to the unit and in all but three the diagnosis on admission was thought to be acute myocardial infarction. In 116 of them the diagnosis was eventually confirmed by electrocardiographic and biochemical evidence. There were 23 deaths, but without knowing more about individual patients, in particular the delay before admission to the coronary care unit, this figure has little significance. Of more interest is the fact that resuscitation has been required for ventricular fibrillation on 10 patients in the unit. One patient had two episodes of ventricular fibrillation and another had four. Five of these patients survived to be discharged from hospital. Two elderly patients had cardiac arrest during the journey from casualty and resuscitation was ineffective. This reflects on the importance of placing the coronary care unit within the vicinity of the casualty department. Of seven patients with complete heart block four required transvenous pacing for very slow heart rates with either syncope or cardiac failure. Of these seven patients six have left hospital. Two patients with ventricular tachycardia have required cardioversion under general anaesthesia; both survived.

There may be several other benefits to the patient in the form of early diagnosis and treatment of heart failure, hypotension, and some of the less immediately serious arrhythmias, and perhaps even from being nursed in a quiet area of the hospital with adequate analgesia. The patients almost without exception appear to be reassured by the constant presence of nursing staff and the calm atmosphere of the unit. The effect, however, of such factors on the morbidity and mortality of myocardial infarction is extremely difficult to assess.

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British Medical Association

Annual Scientific Meeting, Bristol, 10-14 July

The first part of the report of the Scientific Meeting appeared in last week's B.M.J. (22 July, p. 227). The report is concluded below.

Plenary Session on Recreation

Thursday, 13 July

The plenary session on recreation was chaired by the MARQUESS OF EXETER, the former Olympic hurdler. He was introduced by Mr. ROBERT V. COOKE (Bristol). In his opening address LORD EXETER said that there was increasing need in an industrialized world for men to have the opportunity of being fit and healthy, having interesting work to do, and enjoying constructive recreation. If these things were not available the world would soon be populated by neurotics.

Speaking on the need for recreation—in the true sense of the word—the BISHOP OF COVENTRY said that a number of factors were of value in *re-creation*: the first was doing the opposite of one's usual occupation, the second silence—which gave opportunities for reflection and appreciation of beauty—and the third reading. Equally important were faith and service. The present generation

desperately needed the breadth of outlook which could be captured through re-creative recreation.

Sport

Sir ARTHUR PORRITT, turning to the role of sport, described recreation as the recharging of life's batteries. To be effective in refreshing the individual, games and other forms of physical exercise had to be fun, and not purposive like so much modern competitive sport. The Olympic Games had exaggerated competition, and the same thing was tending to happen in schools, where games were moving away from amateurism, which was the essence of true recreation.

Sir CHARLES WHEELER put forward the claims of the arts to have therapeutic powers.

He quoted from *Painting as a Pastime*, in which Sir Winston Churchill had related the pleasure he found in painting. Sir Charles went on to expand on the joys of exploring what he described as the three kingdoms of colour, form, and light and shade. Within every individual there was the capacity for appreciation of these qualities, and those who wished to explore them could do so through the medium of the arts and be richer for the experience.

Gardening

Professor ALAN R. GEMMELL, discussing what he described as one of the most popular forms of recreation in England, outlined the virtues of gardening. The development of small modern gardens in Britain had followed the industrial revolution and had later spread all over the world. Gardening today owed its popularity to a number of factors. It provided a change of occupation, a means of