

The Coronary Care Unit: Miracle of Modern Medicine or Technology Out of Control?



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The Coronary Care Unit (CCU), created in the 1960s, has changed substantially since its inception. Originally designed strictly to treat heart attack patients in imminent danger, it is used today as an observation unit and treatment facility, incorporating many advanced technologies not originally designed for use in the CCU. The clinical effectiveness of the CCU has been understudied, and thus, represents a perfect case study for examining the proliferation of technology in the medical field, and its respective benefits and drawbacks. This article aims to investigate the development of the CCU, and address the question of what lessons can be learned through an assessment of the CCU's evolution. While the CCU is undoubtedly a miracle of modern medicine, we must remain vigilant

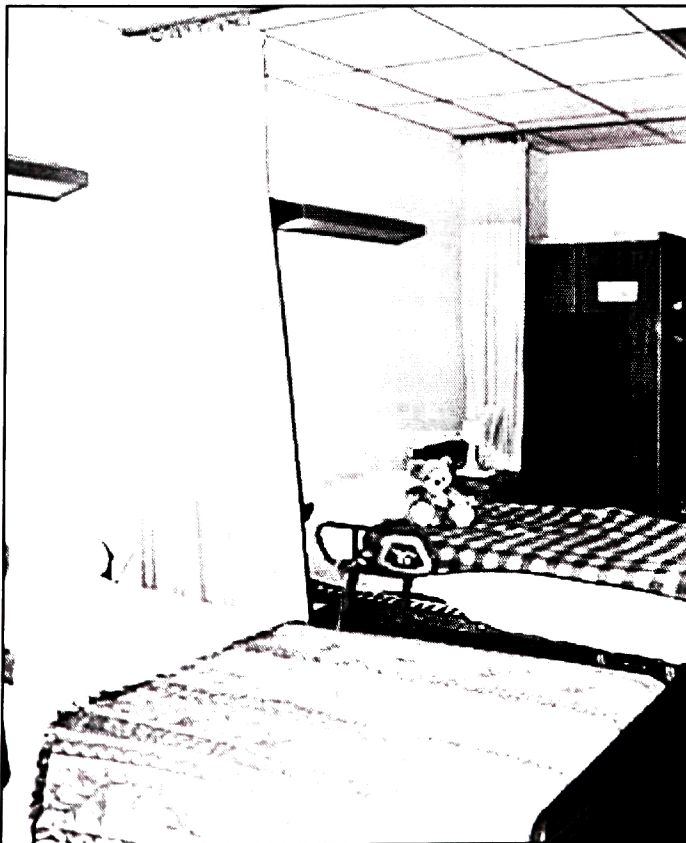
when assessing new technologies, using the best evidence-based techniques to assure that resources and money are not being utilized in practices that are inefficient.

INTRODUCTION

When we see doctors reviving heart attack patients or injecting patients with 'miraculous' drugs on television, these patients are almost always located in the Coronary Care Unit (CCU) of the hospital. The CCU—created during the 1960s after technological advances such as the invention of the electrocardiogram (EKG) and the external defibrillator—has proven to be one of the most glamorized aspects of modern medicine. The CCU represents a microcosm of many technologies found within the medical world, and according to Naggan, is a perfect case study in examining the proliferation of technology in medicine. This is because it is a complex system that combines several components of new technologies. The CCU has also been in operation for a number of years, becoming a staple in modern hospitals despite the lack of studies to evaluate its effectiveness—a characteristic of many modern technologies (Naggan, 1986). This article will examine the history of the CCU, emphasizing that although initially heralded as a technological breakthrough capable of changing the face of cardiac care, its value and effectiveness should be more thoroughly scrutinized.

CARDIAC CARE AND THE DEVELOPMENT OF THE CCU

The history of the treatment of cardiac conditions (such as Acute Myocardial Infarctions (AMI)) has changed substantially over the past hundred years. In the early 1900s, the treatment of AMI "was characterized by benign neglect" (Khush, Rapaport, & Waters, 2005). Patients who arrived at hospitals were placed on bed rest, and often sedated. They were generally removed

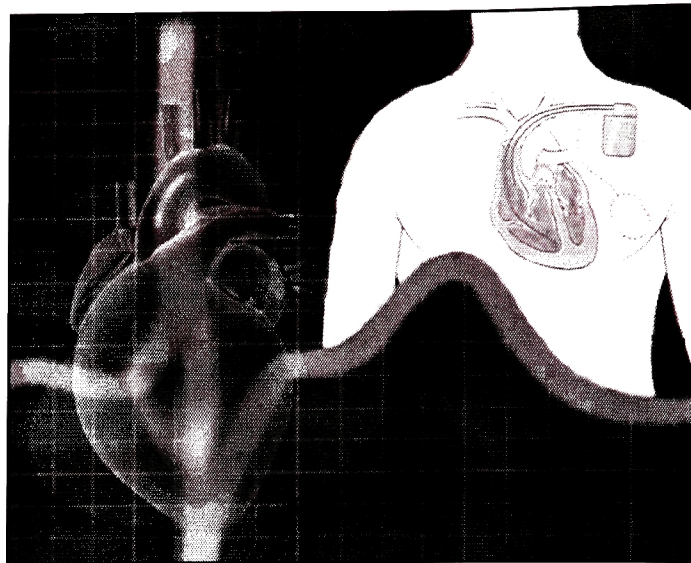


from the noisy areas, such as nursing stations. By the 1920s, it was recommended that physicians do everything in their power to “spare the patient any bodily exertion” for fear of cardiac arteries rupturing (Wearn, 1923). Patients were often treated with stimulants such as camphor and caffeine in order to help prevent heart block and hypertension, both potential complications of AMIs. In 1928, a journal article published in *The Lancet* reported that, Dr. Parkinson and Dr. Bedford advocated for morphine to alleviate pain, and for abstinence from any chemicals that may cause hypotensiveness. Additionally, rest was paramount, as “the return to ordinary life [should be] postponed as long as possible” (Parkinson & Bedford, 1928). Mortality from AMI at this time was estimated at 30% (Braunwald, 2003).

Cardiac care remained largely unchanged until 1947 with the “discovery that ventricular fibrillation could be reversed”¹. This discovery, made serendipitously by Dr. Beck during an open chest surgery in 1947, was later confirmed on another patient indicating that physicians could resuscitate a patient with a previously fatal MI. From this point on, AMIs and cardiac arrests were treated with cardiac massage and internal electrical defibrillation until the next leap in technology led to the external cardiac defibrillator. Invented in 1956, the external cardiac defibrillator provided the impetus for the creation of the modern CCU. In 1960, Dr. Kuwerhoven and colleagues at the Johns Hopkins School of Medicine “demonstrated the efficacy of combining mouth-to-mouth breathing with sternal compression and external electrical defibrillation” in aiding an ailing patient (Khush, Rapaport, & Waters, 2005). With this final step, the CCU was created.

The modern CCU was the brainchild of a Scottish physician named Desmond Julian, who in 1961, envisioned a hospital unit designed specifically for cardiac care encompassing the following four criteria:

- a) Continuous electrocardiographic monitoring with arrhythmia alarms
- b) Cardiopulmonary resuscitation with external ventricular defibrillation
- c) Admission of patients with AMI to a single unit of the hospital where trained personnel, cardiac drugs and specialized equipment were available, and
- d) The ability of trained nurses to initiate resuscitation



These principles were later adopted internationally in select hospitals, where their initial results were challenged by both physicians and medical journals. Within six years, however, with the continued persistence of Dr. Julian and a limited number of studies indicating the success and lower mortality rates of those treated in CCUs, “virtually every community hospital in the United States and Canada had either established a formal CCU or designated several beds for the specific care of patients with AMI” (Bahr, 2000). In Canada, the first CCU was established in the 1960s by Dr. Robert MacMillan and Dr. Ken Brown at the Toronto General Hospital, which is now part of the University Health Network (University Health Network, 2005).

The CCU continued to evolve, and began to include more complex therapies, as well as drugs designed to prevent arrhythmias. In addition, it became accepted in the medical community that the CCU was the only way to treat nearly all types of cardiac conditions. This was in spite of warnings by some cardiologists that CCUs were being used haphazardly and inefficiently (Burch & Giles, 1971). By the late 1960s, doctors were publishing studies demonstrating that certain drugs should be administered in the CCU and advocating for the use of more invasive and technology-intensive procedures within the unit. These approaches gained tremendous support for many years until a landmark study was released in 1989 indicating that many of the drugs that suppressed ventricular arrhythmias actually “increased mortality in postmyocardial infarction patients” (Khush, Rapaport, & Waters, 2005).

¹ Ventricular Fibrillation (VF) is a condition that occurs when the heart muscle no longer pumps in a coordinated fashion. This can lead to a drop in blood pressure, and often, to cardiac arrest.

THE ROLE OF THE MODERN CCU

In the past twenty years, other new technologies have made their way into the CCU, including advanced catheters, new drug treatments, and an abundance of interventional cardiological methods. What is important to note is that according to physicians, many of these interventions do not actually belong in the CCU. Given the current hospital structure, however, these new treatments and technologies have made their home in these ever-growing units. Many of these new interventions are known as 'interventional cardiology', and belong in 'step down' units. However, "the difference in care between the CCU and cardiac 'step down' units has blurred, which has led to great debate on the continuing utility of large, specialized CCUs" (Khush, Rapaport, & Waters, 2005). In addition, with the advent of primary percutaneous coronary intervention, which lowers mortality and morbidity, many patients with AMIs no longer need to be in a formal CCU (J. Velianou, personal communication, October 27, 2006).

PROBLEMS AND ISSUES IN THE CCU

As previously noted, the invention and implementation of CCUs was not without controversy. The primary issue arose from the fact that little research had been done to test the effectiveness of the CCUs (compared to traditional in-hospital care or home care). Naggan posits that the unprecedented adoption of CCUs and the speed at which they proliferated was due largely to the fact that before the invention of the CCU, little could be done to treat AMI patients. In other words, "this proliferation probably reflects the frustration at how little could be done for MI patients [...] rather than comprising scientific proof of CCU effectiveness" (Naggan, 1986). Despite the few studies available examining the issue, most have concluded that CCUs offer no significant reduction in mortality rates, as compared to rural hospitals without these complex units (Goldman, 1982; Hill et al., 1978). That said, certain conditions were treated more successfully in urban hospitals with CCUs than rural ones (Marshall et al., 1968).

Many researchers have also commented on the lack of "good" studies (randomized clinical trials) examining the effectiveness of CCUs. The existing studies have largely been criticized for their

many biases and confounding factors. For example, observational studies that examined mortality before the introduction of CCUs compared to after their implementation were criticized (and subsequently discounted) due to changes in the labelling of AMIs². In fact, the only two studies measuring the quality of CCUs found that there was no difference in results when comparing CCU care to home care. Mather's study showed that it was actually safer to stay at home than to go to the CCU (Mather et al., 1971)³.

One reason for this seemingly counterintuitive result is, as Mather argues, that CCUs produce the same arrhythmias the experts are treating. In other words, the conditions of the CCU, and the subsequent stress on patients generated by such an environment, have resulted in increased abnormal heart rhythms. Thus when they are successfully treated, CCUs claim to have saved patients' lives, when in reality, had they been at home, the patients would not have been in danger in the first place (Cox, 1978). It is important to note, however, that Mather's interpretation is based on studies conducted over thirty years ago, and the treatment of AMIs has changed drastically since then.


One concern that emerged in the 1980s and remains present today is the admission of suspected AMI patients: those who have symptoms that may or may not be the result of an MI. Estimates have pegged this figure at approximately 70% of all CCU admissions, and these patients are proving to be a significant strain on the healthcare system, both financially and in terms of human resources (Fineberg, Scadden, & Goldman, 1984).

Despite these criticisms, it is important to note that the CCU is an integral part of hospitals. Not all measures require the support of research evidence before implementation. Many patients suffering cardiac distress or failure must be put on ventilators and treated with other specialized equipment. For these individuals, the tertiary care available in the CCU is undoubtedly necessary and considered "good practice". At the same time, advances in medical technology allow physicians to postpone death, regardless of the subsequent quality of life (Molloy et al., 1991). Individual beliefs, as well as the wishes of their patients and families, guide physicians' uses of modern and frequently invasive technology. In addition to cost-effectiveness, ethical issues such as defining "end-of-life" should be considered in the evaluation of the clinical value of CCUs.

² After the introduction of CCUs, the classification (labeling) of AMI became different, and as a result, many more cases were classified as AMIs. Before CCUs, these cases would not have been called such, and as a result, the legitimacy of the study was undermined.

³ That being stated, this study is somewhat dated, and should you or someone you know experience heart-attack like symptoms, consult a physician.

FUTURE EVALUATIONS OF THE CCU

The CCU exemplifies an inextricable link between medicine and technology. Developed in the 1960s when almost nothing could be done for AMI patients, the CCU today represents an amalgamation of technological advancements and esoteric professional knowledge. However, its clinical effectiveness has not been closely studied, and previous studies are suspect due to high degrees of bias and other confounding factors. While this article does not discredit the coronary care unit, its intent is to stimulate discussion and research in order to question its value today. The startling lack of contemporary research into the utility and success of CCUs may be a symptom of a problem that affects the medical community at large – that technologically advanced practices are rarely questioned and their effectiveness rarely examined. We must remember that even though a specific technology may be the newest and most advanced, it is not necessarily the most efficient. In an era of spiralling healthcare costs and finite human resources, this message should be heeded carefully. 

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