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**MEDICAL EDUCATION**

## Educating Resident and Fellow Physicians on the Ethics of Mechanical Circulatory Support


Elizabeth A. Sonntag, MD, Keyur B. Shah, MD, and Jason N. Katz, MD



**Abstract**

Mechanical circulatory support (MCS) such as extracorporeal membrane oxygenation, left ventricular assist devices and total artificial hearts have altered the natural history of heart failure, and specialists in the fields of cardiology and cardiothoracic surgery are faced with more complex ethical considerations than ever before. Residency and fellowship training programs, however, do not have formal curricula in medical ethics as it applies to MCS. In response, this article proposes that ethics be integrated into graduate medical education with a focus on the following 6 constructs: patient best interest, respect for autonomy, informed consent, shared decision making, surrogate decision making, and end-of-life care. Curricula should offer learning experiences that help physicians navigate common ethical challenges encountered in practice.


### Ethical Dilemmas in Cardiology and Cardiothoracic Surgery

Important innovations in the fields of cardiology and cardiothoracic surgery have significantly prolonged survival in patients with heart failure (HF), changing the scope of practice for many physicians. Although mechanical circulatory support (MCS) therapies, including extracorporeal membrane oxygenation (ECMO), left ventricular assist devices (LVADs) and total artificial hearts (TAHs) have altered the natural history of previously fatal conditions, these devices are not free of complications and do not necessarily lessen the impact of severe comorbidities. Consequently, physicians tasked with providing sophisticated medical care to patients with escalating illness severity are faced with ethical dilemmas.

A prominent clinical ethicist, Mark Siegler, asserts that ethics should be continuously taught at all levels of medical school and residency[1]; however, this is not the case. Ethics curricula were established in most American medical schools by the 1970s[1] and are now typically offered only in classroom-based learning environments during the preclinical years. There are no explicit ethics requirements for residency or fellowship programs.[2-4] Thus, specialty physicians can lack training in bedside clinical ethics pertinent to their medical specialty. This gap also applies to cardiologists and cardiothoracic surgeons who provide MCS for patients with HF, as specific training in MCS therapies comes later in

fellowship training—generally 5 to 8 years after preclinical ethics education. Although there are specific training requirements for specialists in cardiology, HF, and cardiothoracic surgery (for example, exposure to advanced HF and MCS devices),[2-4] most will have no formal education in ethical issues related to life-sustaining therapies. Some physicians thus might feel unprepared to navigate ethical complexities concerning respect for patient autonomy, shared decision making, quality of life (QOL), and end-of-life (EOL) care. Therefore, preparing physicians to care well for patients with MCS devices should include integration of ethics into residency and fellowship training.

**MCS for Treatment of HF**

HF is a clinical syndrome in which the heart is unable to effectively deliver oxygenated blood throughout the body due to myocardial infarction (ie, heart attack), arrhythmias, hypertension, viral infection, inherited diseases, or other conditions. Symptoms include fatigue, breathlessness, fluid retention, and activity intolerance. Despite standard therapy, HF is a progressive disease. The end stage of HF is marked by frequent hospitalizations and poor QOL.[5] While heart transplantation is a life-saving intervention, few patients are eligible.[6]

Implantable MCS devices offer an important alternative therapy for end-stage HF. An LVAD is a pump implanted in the patient's chest in order to augment blood flow. Patients can carry out many of their usual activities with an LVAD in place. Initially used as a bridge to heart transplantation, permanent implantation of LVADs has now been approved as a destination therapy and has been shown to improve survival and QOL in patients who are not transplant candidates.[7] ECMO, which takes over for failing heart and/or lungs by circulating oxygenated blood, is a last-resort therapy that takes place in an intensive care unit and is typically limited to use in managing potentially reversible conditions or as a bridge to definitive therapy. It can be utilized for acute HF or as part of the cardiopulmonary resuscitation (CPR) algorithm.[8]

Despite their promise, these technologies have limitations and complications. LVAD survival at 4 years postimplant is 49%; common complications include bleeding, stroke, infection, and continued HF.[9] Common ECMO complications include hemorrhage and neurological injury,[10] and it can be difficult to predict whether and to what extent a patient's underlying condition is modifiable or whether a patient will be a candidate for definitive therapy. These outcomes, in addition to considerations about QOL and caregiver burden, play a role in decisions about whether and when to use MCS.

Some ethical questions raised by these technologies include (1) How can we ensure a patient's best interest is upheld when risk-benefit analyses and predictions of QOL with new technologies are becoming increasingly complex? (2) How should shared decision making and informed consent happen when these therapies are implemented

emergently? (3) To whom should life-sustaining therapies be offered and according to which criteria? (4) When is it permissible to withdraw MCS devices?

**Incorporating Ethics Education Into Cardiology Training**

Trainees in cardiovascular disease fellowships are required to train in centers with robust critical care and surgery programs to ensure exposure to advanced HF and MCS devices.[2] Surgeons and HF subspecialists respectively implant and manage MCS devices. The American College of Cardiology recommendations for training in adult cardiovascular medicine and the Accreditation Council for Graduate Medical Education program requirements for cardiovascular disease, heart failure and transplant cardiology, and thoracic surgery highlight many important ethical concepts (see Supplementary Appendix Tables S1 and S2).[2-4,11] However, neither body gives a comprehensive list of objectives that reflect the ethical complexity of problems trainees face in practice. For example, important constructs such as surrogate decision making and withholding or withdrawing life-sustaining therapies tend not to be addressed at all. Training programs are left to consider, with little guidance, how medical ethics should be integrated into their curriculum, which principles to teach, and who will do the teaching.

*Ethics content*. We propose that, before they practice independently, all trainees achieve competency in the following 6 areas: (1) patient best interest, beneficence, and nonmaleficence; (2) respect for autonomy; (3) shared decision making and informed consent; (5) surrogate decision making; and (6) EOL care, including withholding and withdrawing life-sustaining therapy and palliative care. The phrase, *primum non nocere* ("first, do no harm") is adapted from the Hippocratic Oath and captures the concept of nonmaleficence. Understanding clinical indications for and benefits of MCS must be balanced with anticipated outcomes and careful consideration of QOL to ensure no—or minimal—harm to a patient. Thus, trying to balance nonmaleficence against beneficence (doing good) can help a clinician to determine what is in a patient's best interest. A physician's role is to guide patients in shared decision making, which takes into consideration a patient's values and preferences in addition to evidence-based recommendations and anticipated outcomes. Because MCS requires a procedural intervention, informed consent is also necessary. Informed consent, which has both a legal and an ethical justification, helps ensure that patients have needed information about risks and benefits of a particular treatment or procedure. In many cases, patients are critically ill or incapacitated prior to initiation of MCS, and clinicians must rely on advanced directives or surrogate decision makers to determine a patient's values and preferences with a view to predicting how a patient might choose under the current set of circumstances (assuming an advanced directive is not available). Ultimately, MCS should be withheld if its application is not consistent with a patient's health care goals or if its use is expected to cause more harm than good.

*Ethical dilemmas*. Understanding when it is ethically permissible to withdraw MCS is a complex and nuanced topic that requires consideration of social, psychological, and QOL factors. Even when MCS use is initially consistent with a patient's goals of care, stakeholders should be prepared for these goals to change, and physicians who offer life-sustaining therapies must be prepared to constantly re-evaluate the appropriateness of therapy. And even when patients give informed consent and engage in shared decision making, it is incredibly hard to prepare a patient for complications that can arise with an LVAD.[12] As circumstances change and complications set in, some patients might wish to have the device removed, and physicians must be prepared to manage requests for withdrawal. Likewise, unforeseen complications of ECMO can threaten a patient's transplant candidacy, and, in consequence, physicians can be tasked with difficult discussions about timing of ECMO discontinuation. Withdrawal of MCS devices is often disconcerting to stakeholders, as many patients are conversant and even ambulatory but are nonetheless likely to die within an hour of withdrawal.[13]

In fact, there has been considerable debate over whether removal of MCS devices is ethically permissible at all. Most argue that it is, as it follows the same moral algorithm of withdrawal of other life-sustaining devices (eg, withdrawal of invasive ventilatory support).[14] However, others argue that discontinuation of MCS is permissible only when a patient has another life-limiting illness and that discontinuation of MCS is akin to physician-assisted suicide (PAS).[15] A survey of physicians found that 60% of cardiologists (vs 2% of palliative care physicians) agreed a patient must be immediately dying in order to remove or deactivate an LVAD.[16] Furthermore, in the same study, 13% of cardiologists considered doing so to be a form of PAS or euthanasia.[16] The discrepancy between cardiologists' and palliative care physicians' perceptions might reflect differences in comfort with and training in EOL care.

Many clinicians are uncomfortable with EOL discussions.[17] Although the American Heart Association recommends that patients with HF have their values, goals, and preferences re-evaluated yearly,[18] physicians often fail to include discussion about advanced HF therapies like MCS in their EOL conversations with HF patients.[17] Furthermore, care of dying patients continues to be misaligned with their stated wishes,[19] suggesting that current practices are probably not adequate. Most clinicians are eager to acquire more skill in managing these conversations,[17] and we believe this need could be addressed with further graduate medical education. The goal of integrating ethics education into cardiology and cardiothoracic training programs is to prepare physicians to navigate ethical dilemmas specific to initiating, continuing, withholding, or withdrawing MCS.

*Skills for managing ethical dilemmas*. Trainees should be taught how to balance benefits and harms in ways that integrate patients' preferences and values with clinical judgment. They should be trained to recognize that each individual patient has his or her own set of motivating factors when it comes to making decisions about health care. For example,

given the high stakes of HF treatment, patients tend to err on the side of choosing life-prolonging therapy without fully understanding complication rates and potential impact on QOL.[20] Therefore, trainees should be prepared to address how fear and emotion affect patient decision making.[20] In addition, trainees should be aware of the emotional toll of having a loved one who is ill and, when working with surrogate decision makers, encourage them to use substituted judgment rather than making decisions based on fear, stress, or their own personal values.

They should also practice conducting conversations about initiation of MCS devices and adapting them to different clinical scenarios. For example, in discussions with patients or surrogates, physicians should be transparent about the fact that clinical outcomes for ECMO are still being evaluated and that consequences of its broader application, such as during standard CPR, remain unclear.[10] In order to care for patients undergoing treatment with MCS, trainees should be educated about the importance of regularly re-examining the appropriateness of therapy and goals of care. Throughout the care of patients with HF—and when considering withdrawal of MCS—expressing respect for patient autonomy should be a guiding principle. Further training in ethics and decision making at the end of life could help motivate ethically appropriate decision making about MCS[21] and help clinicians determine under which circumstances withdrawal of MCS devices is ethically permissible. Finally, steps should be taken to mitigate burnout and ensure trainees' well-being as they learn to navigate clinical and ethical complexities of caring for patients with HF at the end of life.

There are a number of ways ethics can be integrated into graduate medical education training. For example, ethics curricula for trainees in cardiology, HF, and cardiothoracic surgery could be didactic, case based, or bedside based. Whenever possible, ethics curricula should be taught by a physician with special training in ethics.[4] If needed, faculty development programs should be established within the specialty so attending physicians can become adept teachers.[21] Ethically challenging cases should be reviewed in the form of case conferences or morbidity and mortality meetings so that a large group of physicians can learn from a single case. Bedside application of clinical ethics could take many forms, including modeling of how to express respect for a patient's autonomy and how to facilitate informed consent and shared decision making in day-to-day encounters (see Table). Trainees should also be actively involved in selection meetings, decisions about specific patients' MCS candidacy, and advanced care planning with patients and their loved ones.

**Table.** Application of Ethical Constructs in Bedside Learning

| Ethical Construct | Application |
|---|---|
| Best interest | • Understand medical indications for procedures, medications, and other treatments.<br>• Include quality of life considerations in your evaluation of what is best for the patient.<br>• Attend and be actively involved in selection meetings surrounding LVAD, ECMO, TAH and transplant candidacy. |
| Respect for autonomy | • Elicit patients' values through advanced care planning on a regular basis.<br>• Respect patients' choices as they pertain to their care plan.<br>• Avoid conflicts of interest. |
| Informed consent | • Obtain informed consent for all procedures. |
| Shared decision making | • Thoughtfully discuss indications, risks, benefits, and possible outcomes when making decisions about care.<br>• Elicit patient values in relation to treatment plan. |
| Surrogate decision making | • Counsel surrogate decision makers on the meaning and use of substituted judgment when making decisions for loved ones.<br>• Develop a physician-surrogate relationship similar to the patient-physician relationship. |
| End-of-life ethics | • Counsel patients on end-of-life issues, including withholding or withdrawing life-sustaining treatment and palliative care.<br>• Interact with palliative care consultation service and ethics consultation service regularly. |

Abbreviations: ECMO, extracorporeal membrane oxygenation; LVAD, left ventricular assist device; TAH, total artificial heart.

## Conclusion

As technology advances, applying ethics constructs to patient care seems to be increasingly complicated. More formalized curricula in ethics are needed to help physicians recognize and manage ethically challenging aspects of patient care.[22] It is important for this training to be woven into graduate medical education so that the concepts taught are specific and applicable to the trainees' future day-to-day practices. Curricula should aim to help physicians navigate most of the ethical issues they will confront in practice.[23]

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**Elizabeth A. Sonntag, MD** is a pulmonary and critical care fellow at the University of North Carolina (UNC) at Chapel Hill and an alumna of the MacLean Center for Clinical Medical Ethics at the University of Chicago. She serves on the UNC Hospitals Ethics Committee and teaches an elective in medical ethics at the UNC School of Medicine. Her clinical interests include pulmonary hypertension and critical care, and her research interests include end-of-life decisions, advanced life-sustaining therapies, clinician burnout, and development of medical ethics curricula.

**Keyur B. Shah, MD** is chief of the Section of Heart Failure and the medical director of the Mechanical Circulatory Support Program at the Virginia Commonwealth University Health Pauley Heart Center in Richmond, Virginia. His clinical and research foci include heart transplantation, amyloid cardiomyopathy, and mechanical circulatory support.

**Jason N. Katz, MD** is an associate professor of medicine and surgery as well as the director of the Cardiovascular Critical Care, Mechanical Circulatory Support, and Cardiogenic Shock Program at the University of North Carolina at Chapel Hill. His research interests include optimal models of care delivery for patients with cardiovascular critical illness and for those with end-stage heart disease.

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