



FEATURE

ESSAY

Towards regeneration: the evolution of medicine from fighting to building

We should retreat from metaphors of war in medicine and look to regenerative medicine in its broadest sense, say **Ian Hargraves and colleagues** with a focus on rebuilding both bodies and lives

Ian G Hargraves *assistant professor*¹, Atta Behfar *associate professor*², Jilian L Foxen *instructor*², Victor M Montori *professor*¹, Andre Terzic *professor*²

¹Knowledge and Evaluation Research Unit, Department of Medicine, Mayo Clinic, Rochester, Minnesota, USA; ²Department of Cardiovascular Medicine and Center for Regenerative Medicine, Mayo Clinic

The practice of medicine and the art of caring for patients are evolving, driven in part by the new epidemiology of chronic disease and the technological advances made to tackle it. Medicine is increasingly shifting its focus from combating disease to helping to build or rebuild human life.

The shift is adaptation more than inspiration. When infection was the major threat to survival, medicine responded with better sanitation and nutrition, antibiotics, surgical debridement, and supportive care. Some patients succumbed “after a long battle”; others recovered, often with battle scars.

In an era of chronic non-communicable conditions, the long criticised fighting metaphor feels antiquated.^{1,2} Now we live, and eventually die, with diabetes, heart failure, rheumatoid arthritis, chronic obstructive pulmonary disease, or as a survivor from a battle against cancer or against sepsis in the intensive care unit. When no enemy remains, or when defeat of the enemy is not achievable, fighting and thinking of medicine as a fighting force is often cruel, counterproductive, and futile.

The specialty of regenerative medicine has contributed remarkable technological achievements at the fringes of medicine, but the term and practice have a broader significance. We propose recognising that regenerative approaches in medicine extend from the need to combat illness and injury to the rebuilding and regeneration of lives affected by chronic disease.

Patients' needs

Medicine can complement fighting disease with building health. In the case study ([box 1](#)) the blockage in the patient's coronary artery was an immediate threat, but resolution of the patient's situation and the reintegration of his life and family cannot be achieved solely by eliminating that threat. In the first scenario,

a fighting strategy suited to an immediate threat is continued beyond its usefulness. Care and the patient's life and outlook are oriented against the potential foe of heart failure.

Box 1: Case study—from fighting to building

A 56 year old married man presented to the emergency room with chest pain. After initial management he was rushed to the catheterisation laboratory because of large anteroseptal ST-elevations and frequent non-sustained runs of ventricular tachycardia. An occlusive thrombus in the proximal left anterior descending coronary artery was identified and treated with angioplasty and a drug eluting stent. He was transferred pain-free to the coronary care unit.

Scenario 1: Standard care (focused on the fight)

After the procedures, the interventional cardiologist told him that his blockage had been in the “widow maker” artery and that the clot was destroyed with a balloon and a stent. Shocked, the patient learnt that he was lucky to be alive. Dread overcame his wife and children. He was started on two antiplatelet drugs and discharged with a prescription for six weeks of cardiac rehabilitation.

Eight weeks later, his cardiologist told him he needed to continue to fight against his heart disease. Without adherence to exercise, diet, and drugs, his physician admonished, he could develop heart failure, a condition described as being as bad as metastatic cancer. Three months later, the patient was back at the emergency department with chest pain. After a cardiac cause was ruled out, he was prescribed anxiolytics. At home, he took these pills through the day to help stop the feeling that he was about to die. His family treated him like fragile china. His relationships began to suffer, and he could not focus on work. A psychiatrist diagnosed him, like many others who battle, as having post-traumatic stress disorder and anxious depression.

Scenario 2: Regenerative care today (from fighting to rebuilding)

After the angioplasty, the cardiologist showed the patient a picture of the affected artery and treatment. She framed the emergency interventions he had received as restoring the artery's ability to convey blood to the heart muscle, and, with that achieved, she and the patient were rebuilding the patient's functioning and life. She helped the patient and the family understand that patients like him who participate in cardiac rehabilitation and healthy lifestyles go on to have a normal lifespan and did not recommend limiting activity.

Later, she enrolled the family in supporting the patient to implement the lifestyle changes needed. In tandem with cardiac rehabilitation and drugs, the patient and his wife were referred to a counsellor. Cognitive behavioural therapy helped them work towards eliminating fear of activity. Two months later, the patient reported that he hadn't felt so well in years and that he is motivated, with his wife's support, to continue with his lifestyle modification.

Scenario 3: Regenerative care tomorrow (beginning with building)

This scenario is set in the near future. In the emergency department, the patient received an “off the shelf” prophylactic regenerative intervention to protect the heart and avoid arrhythmias before going to the catheterisation laboratory for possible angioplasty. The cardiologist placed a resorbable stent and administered intracoronary biological drugs targeting new blood vessel formation and protecting the heart muscle to avoid scar formation.

After the intervention, the patient learnt that rigorous randomised trials had shown that these treatments could help the heart rebuild itself and protect against future coronary events. Before discharge, he enrolled in, and engaged with, an online support community for patients like him. On discharge, he learnt of the importance of completing a two month evidence based treatment regimen and of participating in cardiac rehabilitation and in counselling with his family. Two months later, his cardiologist found that his heart function was back to normal and that he could stop the new drugs. A year later, the patient went backpacking with members of his online support group. He had not thought about his heart attack in months.

Medicine often constructs imagined surrogate entities to maintain a strategy of fighting, often using the threat of death as motivation. Patients may be asked to “fight” their tendencies to eat too much or sit too long. Or to fight to lower their blood pressure, glucose, or cholesterol. Cancer “survivors” may be asked to stay “vigilant”—with periodic imaging that is analogous to drones scanning the territory to spot a recurrence of the enemy. Patients with fatigue, pain, and functional limitations are asked to “toughen up.” Those ready to die are “surrendering”; the dead have “lost their fight.”

The strategy of fighting grounds medicine on outcomes achievable through resistance and opposition. This focus, however, too often discounts what medicine produces in human lives. In the second scenario, after the work of fighting, the patient, family, and interventional cardiologist explore rebuilding the person and his life. To support this regeneration, they build the foundations of new routines and outlooks appropriate to living well after myocardial infarction. The products of this strategy contrast with the unintended constructions of healthcare: drug schedules that do not work, unsustainable costs,

burdensome self monitoring, and a home that thwarts rehabilitation are poor responses to illness. These degenerative constructions disrupt, alienate, maladapt, and fragment the person and his or her life.³ They are often the product of fighting strategies directed by guidelines and quality targets and motivated by professional and economic incentives.⁴ Beyond fighting, regeneration is required. From tissue to the family, from physiology to the work environment, the rehabilitation, reconstruction, and reinvention of the person are what is needed.

Cultivating conditions for rebuilding

In one sense regenerative medicine refers to the highly technical specialty that includes transplantation of cells or biomaterials, tissue precursors (stem cells), or fully formed organs to recover lost structure and function.⁵ The transplantation of corneas is an example of this sense of regeneration. Yet there is a more important sense of regeneration also operating in this example. Corneal transplants involve the implantation of a donor cornea to secure permissive scaffolding on which stem cells from the recipient find a favourable environment to form a new cornea. This is an example of regeneration through the cultivation of conditions by which material resources—whether they are antibodies, stem cells, donor organs, or, more broadly, resources such as family relationships, attitudes, behaviours, means, time, social programmes, and assistive devices—contribute to the rebuilding of lives. Regenerative care does not just focus on restoring tissue integrity and function but also on cultivating conditions—cultures or environments—in which the body and the person may rebuild.

In the second and third scenarios in [box 1](#), regenerative approaches operate alongside the urgent fight to optimise outcome. The groundwork for the rebuilding that must follow is laid early at the tissue level in the emergency department. Creating conditions that prevent organ deterioration lead to restoration of function, through repair and rebuilding of the injured tissue. Afterwards comes the creation of communities to support the patient after discharge.

This medicine helps people adapt and thrive, to meet their obligations and pursue their hopes and dreams.⁶ Regenerative medicine must facilitate the grafting of therapeutic interventions within the lives of patients with minimal disruption.³ It must also create environments that favour healing.⁷ This medicine contributes to the work of integrating illness into a person's life story, making a life lived well with chronic disease.⁸

Palliative care, physical and occupational therapy, psychiatric and psychological care, rehabilitation, mind-body medicine, and acute and chronic medical care can all be considered regenerative, and this should be made explicit in training health professionals and coordinating their practice. Promoting healthy environments is also regenerative—from creating clean hospitals to the work outside of medical practice of promoting healthy neighbourhoods, workplaces, and societies that advance social justice and maximise people's capabilities, regardless of their health. As new regenerative tissue technologies become available they should take their place alongside practices that cultivate the conditions by which body and soul rebuild and re-create.

Fighting disease will still be necessary, but not to win or lose. Instead it will be a stage in the process of rebuilding the person. Fighting that is not productive has no place. For patients in intensive care, regenerative care starts early, with thinking about how to support living with the consequences of critical illness—dyspnoea, tracheostomy, scars, and chronic pain or weakness—and reintegrating into work and life. For patients

with diabetes, transplantation of stem cells or a pancreas may eliminate the dependency on insulin and the risk of hypoglycaemia, but the patient has to re-engineer life without these routines and with anti-rejection care. For patients with cancer in remission or for patients recovering from open heart surgery, the task is to help their psychology overcome the shadow of their diagnosis or the experience of surgery, to recast their life as that of a healthy person integrated in society.

The evolution of medicine from fighting to building requires reform in how healthcare is delivered and experienced.⁹ Tissue regeneration, when proved safe and beneficial, will find its place in the armamentarium of medicine, but the practice of regeneration should not stop with the injection of stem cells to support the fight against disease.¹⁰ A commitment to help patients regenerate themselves, from the molecular to the social, to adapt and thrive, must drive the practice of medicine.

Competing interests: We have read and understood BMJ policy on declaration of interests and declare that AB, JLF, and AT are supported by the Marriott Family Foundation and the Mayo Clinic Center for Regenerative Medicine. AB and AT

also hold regenerative medicine patents and participate on the boards of companies that commercialise regenerative technologies.

Provenance and peer review: Not commissioned; externally peer reviewed.

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