Abstract
In August 1976, a young man named LeRoy fell from a ledge, fracturing his femur. Major internal bleeding was suspected. During a laparotomy, the trauma team ensured that all internal organs were intact and the orthopedic team set his fracture. Thirty days later, LeRoy died. He had eaten little; each day he only received three liters of glucose, the equivalent of 510 calories, intravenously. The glucose was insufficient to meet his nutritional needs, and he lost over 20% of his body weight during his hospital stay. The cause of death was due to "physician-induced" malnutrition. Meanwhile, a paper around the same time documented that the prevalence of malnutrition in Boston hospitals was 44% and that malnutrition itself was a predictor of higher complication and death rates.

As a result, like-minded physicians formed a society that created training programs and encouraged formation of hospital nutrition teams. Industry produced nutrition formulas and catheters. Complications in sick hospitalized patients plummeted while survival rates rose, and California passed legislation to mandate nutritional support. Though the health care industry recognized the importance of nutrition in patient care, Congress failed to pass fiscal support for nutrition teams. As a result, hospitals disbanded their newly created nutrition teams, nutrition education and skills declined, and hospital complications and death rates have risen again.

There is none as blind as he who will not see.
Matthew Henry
Clergyman
1662–1714

The emergency
I caught up with my residents as they hurriedly pushed the gurney with a combative young man into the OR. They had told me over the phone, shortly after 4:00 a.m., that an 18-year-old man had slipped off a window ledge while trying to break into an apartment some 30 minutes earlier. He was in profound shock with a presumed life-threatening internal hemorrhage, and he needed surgery immediately. They’d meet me in the OR. Fueled by an adrenaline rush, within minutes I was speeding down the Mass Pike to the then Boston City Hospital.

In abdominal cases where internal bleeding is suspected, an on-the-spot test is the semi-quantitative newsprint test. A needle attached to tubing is stuck into the lower abdominal midline. After half a liter of saline is rapidly run into the abdominal cavity, the bag is lowered for saline to siphon back into the plastic
If the return-fluid is turbid with blood so that newsprint cannot be read through it, research shows that the results correlate with major internal organ bleeding. The key to treatment is to get the patient to the OR quickly, open the abdomen, and stop the hemorrhage before the patient bleeds to death. LeRoy’s newsprint test was positive.

LeRoy lay naked on the gurney, and I saw with envy that he had a fine ebony physique—a muscular torso, a thick neck, and well-developed shoulders and arms. He had the classic six-pack abdomen. Several large-bore IVs in his arms were wide open as fluids poured into his veins to prevent his low blood pressure from falling any further. The Foley catheter in his bladder draining cloudy yellow urine suggested blood and perhaps kidney injury. His belly was distended.

Due to inadequate sedation, he was thrashing restlessly, fighting his endotracheal tube that provided 100% oxygen to his lungs. Our eyes met—his wild and with a frightened pleading stare, afraid of death. Reading his mind, I, too, wondered if he’d make it. Abruptly, his head and arms slumped as the anesthetist gave him a slug of a sedative. As we cautiously moved him onto the OR table, I saw that he had a grossly twisted and disfigured left thigh bone from a fractured femur. He was bleeding into his thigh, which was tense and double its usual size, shining with a bluish hue from accumulated blood.

Without scrubbing, I gowned and gloved in haste. The circulating nurse poured a bottle of antiseptic Betadine over his abdomen, which ran down the sides of his belly and dripped onto the floor. She secured the “seat belt” over his good right leg and cradled his fractured leg in pillows. The orthopedic resident was on his way to see the femoral fracture of his warped leg, which had been hastily captured in the ER x-ray, while the anesthetist was fretting about his continued low blood pressure, egging me on and calling out for more units of blood. Together with my resident, we rapidly draped his torso, the wet Betadine soaking through the waterproof drapes, through the front of my operating gown, and onto my shoes. We worked feverishly against time. Shortly before 5 a.m., I made a swift, midline incision through his hairless skin into his abdominal cavity.

I expected to find lots of free blood, but instead, I found nothing. There was no free blood, and a rapid examination of all the organs that usually burst open after such a severe fall showed that they were intact. LeRoy’s shock was due to the continued bleeding into the muscles of his thigh, which tracked up into the retroperitoneal space in his lower back. Some blood had leaked from the retroperitoneum into the abdomen to result in a positive newsprint test. The orthopedic attending and his residents trooped into the OR and questioned my findings.

“Nothing?” he repeated with incredulity. “Even after such a fall?”

The adrenaline rush drained out of me, and although I felt deflated and tired, I was glad for LeRoy because he was going to make it. After closing his belly, the orthopedic team moved in to fix LeRoy’s fracture. He now became their patient. By noon he was moved to the ICU, where he lay in the first bed by the door. During the next few weeks I passed him at least twice a day on my way through the ICU to see my patients during my early morning and late evening rounds; most of the time he was asleep.

After 30 days, LeRoy died. I was stunned by this discovery and descended into the bowels of Boston City Hospital to review his medical records. A post-mortem examination described a grossly emaciated body. His femoral fracture had healed.

**The explanation**

On admission, LeRoy weighed 150 pounds. During his 30-day hospital stay, he had lost almost 36 pounds—just over 20% of his body weight. An order had
been written for an oral house diet, but records showed that he had eaten little. In the absence of a daily calorie count, the amount he had consumed from the meals placed in front of him was missing. The nurses' notes confirmed my suspicion. He had essentially been sustained on an intravenous drip of 5% glucose-saline. One liter provides fifty grams of glucose, or barely 2 tablespoons of sugar—the equivalent of 170 calories. LeRoy had received three liters a day, getting a total of approximately six spoonfuls of sugar (510 calories), or about two candy bars a day, for 30 days.

To survive his injuries from the fall, in addition to the stress of two major operations, he would need at least 3,000 calories per day. To prevent emaciation, he needed not only glucose, but also protein, fat, vitamins, trace elements, and minerals. In their absence, his skeletal, smooth and cardiac muscles broke down to provide his daily nutritional requirements. When he exhausted his critical muscle mass, estimated to be greater than 20% of his weight, LeRoy died in a university hospital in Boston from iatrogenic malnutrition.

The date was August 1976.

To this day, I wonder whether his death certificate truly reflected the cause of death: "physician-induced" malnutrition.

The call to action

In 1974, a paper entitled Protein Status of General Surgical Patients\(^1\) was published in Journal of the American Medical Association, followed in 1976 by Prevalence of Malnutrition in General Medical Patients\(^2\) from the same group of MIT trained physicians at the Deaconess Hospital, Harvard. The Boston Globe printed their essence under sensational headlines, paraphrasing that the prevalence of protein-calorie malnutrition in patients admitted to Boston hospitals was already 44% or greater and that its frequency rose to 60% after 14 days.

Acute or chronic disease diminishes appetite and food consumption, leading to weight loss and malnutrition at a time when sick patients have increased needs for nutrients. Starvation is a predictor of higher hospital or operation-related complications such as pneumonia, sepsis, deep vein thrombosis, or heart attack, leading to a three-fold increase in the death rate\(^3\).

The results of the studies hit the proud Boston surgical community like an atomic blast. The great and powerful senior physicians took umbrage that under their surgical care, the incidence of malnutrition was not only high but increased. The very suggestion implied gross neglect, which simply could not be true. At the time I was a research fellow in a surgical lab...
studying the effects of nutrients on burned patients at Harvard. The reported results in JAMA seemed credible to me, and the memory of LeRoy’s death cemented my subspecialty choice.

The results of the nutrition studies should not have convulsed the Boston medical community. Nearly forty years prior, in 1936, the very same JAMA had published a similar observation by a surgeon named Hiram O. Studley. He reported that in his surgical patients, a weight loss above 20% led to greater complication rates and a 33% death rate. And in 1974, Charles Butterworth, M.D. in Nutrition Today reported comparable concerns in a provocatively titled article, The Skeleton in the Hospital Closet5.

Whether this information was forgotten or overlooked, it seems that each generation of physicians, steeped in the focus of their own specialties, had to relearn basic biological lessons beyond their specific expertise. This was particularly the case during the 1970s, when less than a third of the 130 accredited medical schools in the United States offered a formal didactic nutrition course.

After LeRoy’s death in 1976, I felt a burden of guilt because not only was I LeRoy’s surgeon, but on the basis of my limited nutrition research, I was also Head of the Nutrition Team. After he was transferred to the orthopedic service, I had neither seen LeRoy nor been consulted for this purpose. At the time, the science of nutrition support was new. Any product poured into the gut—alimentation—was ‘food’ and didn’t require FDA approval for its use. Nor was research data required to support its benefit. In contrast, nutrients delivered into a vein were deemed a ‘medication’ needing FDA approval, backed by costly human studies to show their efficacy.

In the 1970s, there were few suitable products to deliver intravenously and only two were approved for enteral use. Additionally, there was a limited number of tubes available for insertion into the gastrointestinal tract and even fewer reliable intravenous catheters. Above all, the caloric, nutritional and micronutrient needs of sick patients with various co-morbidities such as severe trauma, burns, diabetes, respiratory failure, renal or heart disease, were unknown.

As team leader, I worked with three key professionals. The first was a dietitian who was well versed in recognizing and diagnosing specific nutritional problems related to the patient’s disease as well as those induced by the stress of therapy. The second was a clinical nutrition-trained nurse who was familiar with the limited assortment of intravenous catheters and nasogastric tubes, their placement into the patient’s body, and their daily care. If these catheters became infected, they could become a source of a fatal systemic infection. Finally, the team had a pharmacist who was comfortable with the sterile compounding of the nutrients and their compatibility. In sum, these individuals reflected highly skilled nutrition health care providers who recognized, prevented, and treated malnutrition.

At Boston City Hospital, any physician who needed help with a nutrition-related problem or wanted to initiate nutrition therapy had to consult with me. But few medical schools taught nutrition courses, and, as in LeRoy’s case, a burgeoning nutrition-related problem often wasn’t recognized. In response, I had instituted a hospital-wide policy whereby a simple set of questions on admission identified the patients at risk of malnutrition and automatically brought them to the team’s attention. As its head in name only, I felt like a charlatan, for I knew little clinical nutrition. LeRoy’s death was a clarion call to acquire the appropriate knowledge to be an effective, authoritative leader of my team. Nationwide, there were two human nutrition departments. One was at MIT across the Charles River, and the other was at UCLA across the country. Since I had to earn my living as an operating surgeon, my choice was easy.
The rebirth

In late August of 1978, I called the MIT department and inquired how I could learn some practical nutrition. This led to an invitation for an interview with the department head on a Saturday night during his end-of-summer departmental soiree. The gist of our conversation was that MIT’s Department of Nutrition and Food Science needed a physician to supervise ongoing studies in healthy students at their Clinical Research Center. If I was interested, I could attend classes to meet the nutrition course requirements.

I agreed.

What a deal! Somehow I had missed the significance of the code words “course requirements.” It sounded no alarms and held no masochistic connotations of graduate courses, lectures, term papers, deadlines, or exams until a few days later when an MIT admissions officer frantically called me to complete admission forms because the winter term was about to start.

So, at the age of 35 years, after 4 years of college, 4 years of medical school, and 7 years of surgical training, I sat once more with brilliant 22-year-old kids in a classroom. I slumped over my desk during morning classes, performed my elective operations at Boston City Hospital in the afternoon, attended to emergencies at night, and studied diligently every weekend. I suffered from sleep-deprivation and appeared disheveled and unshaven during class. Worried about my very sick patients, I felt like a misfit as the leaders in the field droned on and on about nutrition and its biochemical pathways. My pager, akin to a live grenade, was dangling from my belt, threatening to go off at any moment. I prayed it wouldn’t so I could remain as inconspicuous as possible.

Thus, I lived the double life of an authoritative surgeon on one side of the Charles, and a humble, exhausted, and insecure graduate student on the other bank. Over the course of three very challenging years, I completed the graduate courses and its research requirements. Above all, I attained the knowledge in nutrition that would complement my surgical practice.

The aftermath

The impetus to assess a patient's nutritional status on admission and to provide nutritional support to the “at risk population,” enterally or parenterally, occurred through a groundswell of several simultaneous factors. Among these were the formation of the American Society of Parenteral and Enteral Nutrition, spearheaded by the very same Boston physicians who had previously been maligned for their nutritional research. They gathered physicians, primarily surgeons, along with nurses, dietitians, and pharmacists, who developed guidelines and protocols for the care of patients. Several new peer-reviewed journals were created in response to the growing data. A key partner in the change was the growing health care industry, which responded by providing financial backing as well as developing nutritional products and the equipment for patients. Hubert Humphrey became the movement’s “poster child,” as he became more emaciated in response to cancer treatment without adequate nutrition. Young physicians were trained in this burgeoning new specialty, and nutrition teams were formed in most hospitals in response to published data of positive patient survival and outcomes. The knowledge was exported, and similar national societies were formed in most countries. The State of California passed Title 22—the first legislation to mandate nutritional support.

For a few years we advanced the essential message of nutrition's vital role in sustaining hospitalized patients who could not eat enough to meet their increased nutritional needs. However, concerted efforts failed to persuade Congress of the importance of remunerating physicians and hospitals for their time, efforts, and
materials used. The momentum slowed as teams were disbanded due to lack of funding and political will.

Another forty years have passed, and most of the "young Turks" have retired. The body of knowledge they developed, promoted, and practiced is in danger of being forgotten once again. Few hospitals have formal Nutrition Support Teams today. While most patients are seen by a registered dietitian within 48 hours of admission, the dietitians do not have the authority to write orders or to ensure implementation of their recommendations. The plan they propose is seldom read or acted upon by a busy physician, and it is unlikely that either the dietitian or the physician has been trained in clinical nutritional support. It is critical that this national treasure of vital nutritional information is not lost. The flame must be rekindled, nutrition education formalized once again, and nutritional supported funded by Congress before we wake up to another LeRoy catastrophe.

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