REPRINTED WITH PERMISSION OF EDITOR-IN CHIEF OF ANNALS OF SURGERY: Annals of Surgery: Vol. 266, Nr 5, November 2017; 703 - 705: Modern Surgeons: Still Masters of Their Trade or Just Operators of Medical Equipment?

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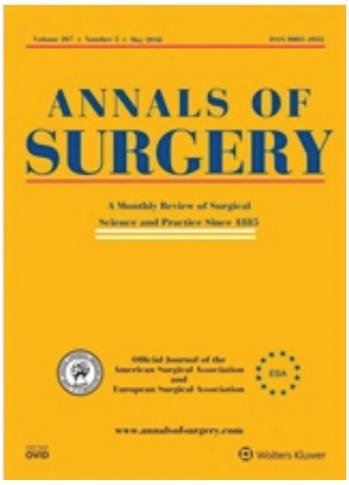
Published: November 2017 Annals of Surgery (ISSN: 003-4932/17/26605-0703): Vol. 266, Nr 5, Nov.2017



My surgical education began at a time when Poland formed part of the communist bloc and was isolated from the world, or in today's terms – it remained behind the Iron Curtain. This was true of all areas of life, including medicine.

When after 40 years of work, I look back at my professional career; I wonder whether I owe my proficiency in surgery to my experience and dexterity or, like many others, to technological progress.

Two of the great Polish surgeons were my mentors and teachers. Professor Zdzisław Łapiński was the one I met first. He was a manual genius and an unusual operational strategist. Granted, he had one character defect, but nobody's perfect after all. In 1975, I defended my dissertation. I was convinced that I should continue my education at a center abroad, preferably within a postdoctoral scholarship. Professor Łapiński wanted me to learn everything about surgery from him. I decided otherwise, and in 1978 with his tacit agreement, I obtained a Humboldt Fellowship and went to Heidelberg, to the department headed by none other than Professor Fritz Linder.[1] I started my research for the habilitation thesis at the *Experimentelle Chirurgie Abteilung* of his Department.

The second of my 2 most important mentors in the field of surgery was Professor Jerzy Szczerbań. He instilled in me an interest in liver surgery. He was the master of portocaval shunts in patients with portal hypertension (which was at that time the method of choice in such patients), and although he had never transplanted a liver himself, I and other doctors in our department received training in liver transplants. It was because of his encouragement that in 1993 I decided to go to Villejuif, to learn from the great master of liver surgery, Professor Henri Bismuth. Just then Professor Bismuth and his team celebrated the 1000th liver transplants at his center.

Undoubtedly, I can still say I belong to those surgeons who received a highly comprehensive education. My surgical training included a variety of urological, neurosurgical, and thoracic surgery procedures, but also the opening an abdominal aortic aneurysm or a femoropopliteal bypass. I have always excelled in abdominal surgery – such as any large intestine, pancreas, and stomach operation. Back then, other surgeons had the same professional training. However, we were witnessing a unique phenomenon. Technological development helped us perform various operations and offer better therapy, but forced us to change our approach to the art of surgery. We had to adapt our manual dexterity in order to operate new equipment, and thus to be able to perform, among others, minimally invasive surgery. I learned laparoscopic techniques from Sir Alfred Cuschieri of the University of Dundee, and I am one of the first surgeons in Poland to have performed such operations.

Let us move on to a historical overview of surgery and surgeons.

During the Napoleonic Wars, Dominique Jean Larrey[2] was the most popular surgeon; according to records dating back to the Russian campaign, he performed 200 amputations of limbs in just 24 hours. One must admit that to achieve such a feat, he had to be a truly great surgeon. Please note that the speed with which he operated was of key importance then, as it was not until about 1830 that the first anesthetics – ether, nitrous oxide, and chloroform – were introduced. However, the likes of Larrey were soon no longer admired due to the development of pathophysiology in surgery, diagnostics, and technology.

In the 1950s and 1960s, the Polish surgeon Professor Józef Gasiński[3] was known for his extraordinary surgical skills – he needed only 15 minutes to perform subtotal gastric resection with anastomosis using a scalpel, Pe´an's forceps, and Kocher forceps, and without staplers, harmonic knife or argon coagulation.

The question arises, whether great surgeons are to be remembered as a bygone generation? Or maybe they were the ones who stimulated technological progress?

During my second Humboldt Fellowship at the Department of Surge-

DOI: 10.1097/SLA.0000000000002364

ry in Mannheim, I witnessed brilliant surgical movements when watching the pancreatoduodenectomy performed by Professor Michael Trede. As a joke, he pretended that he was using a mannheimer laser to coagulate bleeding, whereas in fact, he touched the bleeding area precisely with the forceps and his assistant applied ordinary monopolar coagulation to the forceps. The achievements of Professor Michael Trede's[4] and those of another eminent pancreatic surgeon from Heidelberg – Markus Büchler[5] are well known in the world. Although this operation was first performed in 1909 by Walther Carl Eduard Kausch,[6] it takes its name (Whipple's operation) from its advocate, Allen Oldfather Whipple.[7] All 4 of them were brilliant surgeons who used the so called classic surgical instruments. But nowadays, in the era of minimally invasive surgery, when a surgeon using a laparoscopic technique can perform the same operation, does it mean that she or he is doing something more? In 1994, M. Gagner and A. Pomp[8] first described the Whipple laparoscopic procedure. Does it mean that although Walther Carl Eduard Kausch, Allen Oldfather Whipple, Michael Trede, and Markus Büchler were great surgeons, M. Gagner and A. Pomp are just operators of modern laparoscopic equipment? No – the latter are equally brilliant. To put it simply, they are exceptionally proficient in the application of laparoscopic surgery tools. All modern surgeons make use of technological solutions. Hence, let me stress again that I believe the 6 surgeons mentioned above, that is W.C.E. Kausch, A.O. Whipple, M. Trede, M. Büchler, M. Gagner, and A. Pomp can be considered truly great.

Let us look at modern surgeons who operate using a robotic surgical system. Is G.B. Cadierē,[9] who in March 1997 performed the first cholecystectomy with a robot, a great surgeon?

Robotic arms repeat the movements of a surgeon sitting at the console. Opponents may say it is the computer technology and the development of medical engineering that makes it possible to perform surgery. True enough, but who should sit at the controls? Naturally the surgeon, sceptics of this technique wonder: what happens if complications arise, whether the surgeon using the robot will open the abdomen and correct the complication. Looking forward, I think that robotic surgery will become effective enough to allow us to correct any complications with its own techniques.

With technological advancement, new training was developed for surgeons in the field of robotic surgery. Trainees are asked to analyze video recordings of self-performed surgeries. Hence, training comes from the assessment of one's own mistakes and not from a mentor. There is still standard training in robotic surgery where an experienced surgeon observes trainees performing surgery, gives feedback about their movements, and corrects the results of their mistakes.

The era of liver transplantation started in Denver, in 1963. Its pioneer was Thomas Starzl.[10] He was undoubtedly both a great surgeon and a very creative personality. Not only was he brilliant, but he was also set on constantly improving his technique. What is more, he excelled in solving various logistical or organizational problems.

The example of Thomas Starzl shows that outstanding professionals are not born, but achieve mastery through hard work. T. Starzl obtained his PhD in neuroscience, and then focused on human open heart operations. He was researching liver surgery at the time when canine auxiliary liver transplant model suggested by Welch yielded poor results.

Starzl carefully considered the problem of liver's double blood supply. In addition to surgical technique, he was fascinated with immunosuppression, chimerism, and other issues related to organ rejection. This clearly proves that Starzl, apart from being a great surgeon, also had extensive knowledge of medicine in general. Did technology make life easier for him? Definitely yes. The development of diagnostic equipment paved the way for assessing blood flow in transplanted hepatic vessels (Doppler), and advances in computer tomography made it possible not only to diagnose focal hepatic lesions, but also to visualize the vessels in the transplanted liver using CT angiography. The tremendous progress in biliary research using retrograde cholangiopancreatography offered a chance of treating many patients with postliver transplant biliary complications. And yet, regardless of the above development, Professor Thomas Starzl, Sir Roy Calne, Professor Henri Bismuth, can still be considered great surgeons and visionaries. Technology has always been helpful, but one should never value it over people.

Vascular surgery is not my strong point, although I have performed many vascular surgeries, also on patients with Leriche syndrome.

Let us recall the French surgeon Renē Leriche.[11] As early as in the 1930s he voiced his concern that one day a surgeon would have to operate on a patient who was not examined by him. Leriche believed technical skills would become more important than the therapeutic dimension of surgery. Would the term surgeon still mean a great professional then, or merely a trained craftsman? Should Leriche turn out to be right about the future, I believe the latter would be the case.

Renē Leriche warned against the dehumanization of medicine. He compared the pace of changes in medicine with that of a raging hurricane that brings new technological solutions. On the one hand this is great, but on the other hand, it should never make us forget the people these solutions are intended to serve. Leriche believed the new technologies were not an end in itself, but a means to help patients.

I think we should remember this comment, because, though stated as early as in the 1930s, it has become even more significant in the new millennium due to the extremely turbulent development in surgery. Though Leriche warned against fascination with technology, he also stressed that to work properly the surgeon needed to be well equipped.

To explain the concept of a surgical genius let me quote R. Leriche:

"When it comes to surgery if the surgeon believes the task to be difficult and has a sense that he does not possess all the required qualifications, his duty is nothing but to leave the scene with humility to those who are more competent on this particular task."

The notion of "being aware of one's own skills" is one of the principal foundations of morality in surgery. It means knowing the limits of the surgeon's work and avoiding any transgression of the same. A well-thought-out decision to withdraw during a surgery is no reason to feel ashamed.

It is clear from Leriche's quote that a great surgeon not only is proficient in the field of surgery but also analytical and ready to critically assess her or his actions. It is often the case that modern surgeons, even with fantastic equipment and excellent 3D visualization at hand, do commit errors during a laparoscopic surgery. They should not have proceeded if they felt uncertain. Only a surgeon who knows when to withdraw is truly responsible.

Michael Ellis DeBakey, an American surgeon,[12] was another great personality who contributed to the development of surgery and technology. He was an excellent surgeon, and a constructor and inventor at the same time. At the age of 23, he developed a roller pump. Unfortunately, it was first used 20 years later as an essential component of the heart-lung machine. DeBakey was among the first surgeons to perform coronary bypasses. In 1953, he successfully conducted carotid endarterectomy. He pioneered the development of an artificial heart and was the first to successfully use an external heart pump – a left ventricular bypass pump – in a patient. He used Dacron grafts to replace or repair blood vessels in the treatment of patients with occluded arteries. DeBakey's example certainly proves that surgical greatness can go hand in hand with technological creativity.

My friend Professor Daniel Jaeck from Strasbourg told me about his work in Vietnam with Professor Ton That Tung. In the 1930s the latter, then a young investigator and anatomist, spotted a dozen or so roundworms in the intrahepatic bile ducts of corpses he was examining. This prompted him to study liver and bile duct anatomy.

Ton That Tung,[13] as a specialist in anatomy and topography of the liver, disseminated the technique of fissile separation per-formed by fingers, but it was not his invention. This technique was first employed and described by Professor Lin, a Taiwanese surgeon, but his performance was brutal, whereas Tung operated drawing on his knowledge of liver anatomy. In the 1960s and 1970s, Tung performed hundreds of liver resections using finger dissection with a very low percentage of mortality. He was a great liver surgeon who worked without the advances of modern technology, through his outstanding dexterity and knowledge of liver anatomy.

The same can be said of Professor Henri Bismuth. In 1970, he launched a liver transplant program. It was a time when diagnostic methods (Doppler ultrasound, CT, and MR) were not widespread. Would we say that if Professor Bismuth started his transplant program today, he could not be considered a great surgeon, but just an operator of modern equipment? I strongly disagree. Modern technology would only serve as a tool to use and show his mastery, reflected both in his extraordinary dexterity and surgical thinking, which was much ahead of his time.

It may be worth stressing that a great surgeon is more than an excellent professional in terms of performance in the operating room. She or he is a strategist who can decide for or against an operation and think of an operation plan, and who in difficult, often dramatic situations, is able to remain calm and prevent the patient from dying on the operating table. She or he can properly assess the situation and decide not to proceed with surgery if it is not feasible. What is more, she or he can provide adequate postoperative care. A surgeon such as Professor Henri Bismuth, who perfectly fits the above description, would therefore never be considered just an operator of modern surgical equipment.

Now let me quote from an article14 published in the Annals of Surgery in March 2017.

It begins as follows:

"The operating room is a high-stakes, high-risk environment. Previous research has shown that 39.6% to 54.2% of adverse events occur in the operating room, and that one-third to one-half of these adverse events are potentially avoidable."

The quote states that even the best perioperative care cannot reverse the results of surgeons' errors. However, at the same time it stresses that there is a very high correlation between excellent surgical technique and patient intraoperative, postoperative, short--term, and long-term results. Furthermore, the assessment of surgeons' performance should be performed on an ongoing basis, as it allows detecting manual imperfections and technical errors. The assessment of surgeons' performance should not be indirect; it ought to be based on direct observation or observation of their actions recorded on magnetic carriers.

These studies clearly show that surgical skills are paramount to achieving good treatment results.

In conclusion, there is no doubt that despite tremendous technological progress, surgery results largely depend on the surgeons' dexterity. This statement is based on the analysis of various complications and mortality rate. On the other hand, though it is essential to evaluate surgeons directly or using electronic records, their assessment should also be related to the declared quality of life of the patient.

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Word count: 2500 Page count: 4 Tables: – Figures: – References: 14

DOI: 10.1097/SLA.0000000000002364 www.annalsofsurgery.com ISSN: 0003-4932/17/26605-0703

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Cite this article as: Krawczyk M.: Modern Surgeons: Still Masters of Their Trade or Just Operators of Medical Equipment?; Annals of Surgery Volume 266, Number 5, November 2017; 703 - 705

INDEX COPERNICUS INTERNATIONAL

Degloving lower leg injury – the importance of additional treatment: negative pressure and hyperbaric oxygen therapy

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Article history: Received: 03.11.2017 Accepted: 17.12.2017 Published: 30.04.2018

ABSTRACT: Degloving injury poses a severe therapeutic challenge concerning both trauma and plastic surgery. The injury involves separation of skin and subcutaneous tissue from fascia and muscles. Treatment is often long-lasting and brings unsatisfying results due to the extent of damage, risk of infection and massive blood loss.

In this article, we present the management and therapeutic outcomes of a patient admitted due to the degloving injury of the lower extremity caused by workplace accident. We described the complexity of treatment including surgical intervention as well as additional treatment, which combined brought good esthetic outcome.

KEYWORDS: degloving injury, skin graft, hyperbaric oxygen therapy, negative pressure therapy

INTRODUCTION

Degloving injuries are caused by shearing forces acting parallel to the tissue resulting in displacement of the superficial tissue layers. An injury to lower extremities causes tearing off of the skin and subcutaneous tissue from underlying fascia and muscles. Soft tissue injury can be accompanied by extensive damage to the deep structures of the limb. In addition to the detachment of skin and subcutaneous fat, muscle, vessel and nerve damage is often observed together with bone fractures, which requires an interdisciplinary approach covering orthopedic, vascular, general and plastic surgery [1]. Those complications significantly worsen the prognosis.

Such injuries usually involve lower extremities and torso and are caused by traffic accidents, workplace injuries and improper use of agricultural machinery [2].

The extent of injury and high risk of infection can cause life-threatening complications. The risk of therapeutic failure is increased in the presence of concomitant diseases and advanced age. An important poor prognostic risk factor is concurrent long bone fracture [3].

In patients with degloving injuries, a wide range of conservative and surgical approaches may be applied. The easiest technique used in such patients is reattachment of the skin flap. This approach often results in partial or total necrosis of the reattached tissues, especially in the case of circular wounds. According to the literature, flap reattachment and pressure bandage do not yield satisfactory results, especially in the case of circular wounds [4].

Another surgical technique applied in patients sustaining a degloving injury is an autologous skin graft [4]. Directly after the injury and surgical debridement of the donor and recipient site, the graft may be harvested from the flap and implanted into the wound [3,5,6].

In selected cases, particularly of head trauma, it is possible to use the detached tissues as a flap supplied by occipital and/or temporal vessels, which can be reattached using microsurgical techniques [7]. Such procedures can be applied in the absence of significant skin damage and in case of preserved good quality of blood vessels in both the flap and the recipient site. To assess flap vitality and quality of perforators, Doppler ultrasound or fluorescein staining can be implemented [8].

Degloving injury of the lower limb is associated with severe tissue damage and high risk of complications. Hematoma formation, wound infection and later phlegmon can lead to developing sepsis. That complication along with deep venous thrombosis can be life-threatening. Therefore, proper management includes anticoagulation and definitive narrow-spectrum antimicrobial therapy. Early local complications include: bleeding, which can often require blood transfusion, ischemia of distal portions of lower extremities, local infection, while late local complications affect function and esthetics – limb deformation, scarring, sensory loss and lymphedema [2].

Vacuum- assisted closure therapy (VAC™) is helpful in debridement of the wound, especially in the case of coexisting bone fracture [9]. The use of VAC™ as a complementary treatment in combined therapy seems to be an effective method of limiting the extent of tissue damage [10,11,12]. It is believed that negative pressure treatment acts by increasing the cell division rate, facilitating angiogenesis and local production of growth factors [13]. Also, by alleviating edema, VAC™ can increase perfusion at the microcirculatory level [11].

Another method promoting wound healing is hyperbaric oxygen therapy. The use of high concentration oxygen inhibits inflammation, shows an analgesic and bactericidal effect and facilitates creation of new blood vessels (angiogenesis). Furthermore, oxygen facilitates production of collagen, elastin and extracellular matrix by fibroblasts [14, 15]. Wound infection can result in tissue hypoxia despite normal blood supply. Coexisting infection and hypo-