Complications

A Surgeon's Notes on an Imperfect Science

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Introduction

I was once on trauma duty when a young man about twenty years old was rolled in, shot in the buttock. His pulse, blood pressure, and breathing were all normal. A clinical assistant cut the clothes off him with heavy shears, and I looked him over from head to toe, trying to be systematic but quick about it. I found the entrance wound in his right cheek, a neat, red, half-inch hole. I could find no exit wound. No other injuries were evident.

He was alert and scared, more of us than of the bullet. "I'm fine," he insisted. "I'm *fine*." But on the rectal exam, my gloved finger came back coated with fresh blood. And when I threaded a urinary catheter into him, bright red flowed from his bladder, too.

The conclusion was obvious. The blood meant that the bullet had gone inside him, through both his rectum and his bladder, I told him. Major blood vessels, his kidney, other sections of bowel may have been hit as well. He needed surgery, I said, and we had to go now. He saw the look in my eyes, the nurses already packing him up to move, and he nodded, almost involuntarily, putting himself in our hands. Then the gurney wheels were whizzing, IV bags swinging, people holding doors open for us to pass through. In the operating room, the anesthesiologist put him under. We made a fast, deep

slash down the middle of his abdomen, from his rib cage to his pubis. We grabbed retractors and pulled him open. And what we found inside was . . . nothing.

No blood. No hole in the bladder. No hole in the rectum. No bullet. We peeked under the drapes at the urine coming out of the catheter. It was normal now, clear yellow. It didn't have even a tinge of blood anymore. We had an X-ray machine brought into the room and got X rays of his pelvis, his abdomen, and also his chest. They showed no bullet anywhere. All of this was odd, to say the least. After almost an hour more of fruitless searching, however, there seemed nothing to do for him but sew him up. A couple days later we got yet another abdominal X ray. This one revealed a bullet lodged inside the right upper quadrant of his abdomen. We had no explanation for any of this—how a half-inch-long lead bullet had gotten from his buttock to his upper belly without injuring anything, why it hadn't appeared on the previous X rays, or where the blood we had seen had come from. Having already done more harm than the bullet had, however, we finally left it and the young man alone. We kept him in the hospital for a week. Except for our gash, he turned out fine.

Medicine is, I have found, a strange and in many ways disturbing business. The stakes are high, the liberties taken tremendous. We drug people, put needles and tubes into them, manipulate their chemistry, biology, and physics, lay them unconscious and open their bodies up to the world. We do so out of an abiding confidence in our know-how as a profession. What you find when you get in close, however—close enough to see the furrowed brows, the doubts and missteps, the failures as well as the successes—is how messy, uncertain, and also surprising medicine turns out to be.

The thing that still startles me is how fundamentally human an endeavor it is. Usually, when we think about medicine and its remarkable abilities, what comes to mind is the science and all it has given us to fight sickness and misery: the tests, the machines, the drugs, the procedures. And without question, these are at the center

of virtually everything medicine achieves. But we rarely see how it all actually works. You have a cough that won't go away—and then? It's not science you call upon but a doctor. A doctor with good days and bad days. A doctor with a weird laugh and a bad haircut. A doctor with three other patients to see and, inevitably, gaps in what he knows and skills he's still trying to learn.

Recently, a boy was flown in by helicopter to one of the hospitals where I work as a resident. Lee Tran, as we can call him, was a small, spiky-haired kid barely out of elementary school. He had always been healthy. But for the previous week, his mother had noticed he had a dry, persistent cough and seemed less energetic than usual. For the last couple days he'd hardly eaten. She thought it was probably a flu. That evening, however, he came to her pale, tremulous, and wheezing, suddenly unable to catch his breath. At a local emergency room, the doctors gave him vaporized breathing treatments, thinking he was having an asthma attack. But then an X ray revealed an immense mass filling the middle of his chest. They got a CT scan for a more detailed picture. In stark black and white, it showed the mass to be a dense, almost football-size tumor enveloping the vessels to his heart, pushing the heart itself to one side, and compressing the airway to both lungs. The tumor had already completely crushed the passage to his right lung, and without air coming through, the lung had collapsed to a gray nubbin on the scan. A sea of fluid from the tumor occupied his right chest instead. Lee was living entirely off his left lung, and the tumor was pressing down on the airway to it, too. The community hospital he was in did not have the resources to deal with this. So the doctors there sent him to us. We had the specialists and high-tech equipment. But that didn't mean we were sure what to do.

By the time Lee arrived in our intensive care unit, his breathing was a buzzing, reedy stridor. You could hear it three beds away. The scientific literature is unequivocal about this situation: it is deadly dangerous. Just laying him down could cause the tumor to cut off the remainder of his airway. Giving him sedatives or anesthesia could do the same. Surgery to remove the tumor is impossible.

Chemotherapy, however, is known to shrink some of these tumors over the course of a few days. The question was how to buy the child time to find out. It wasn't clear he'd last the night.

We had two nurses, an anesthesiologist, a pediatric surgery junior fellow, and three residents at the bedside, myself included; the senior pediatric surgeon was on his cell phone, driving in from home; an oncologist was on page. One nurse propped Lee up on pillows to make sure he was as upright as he could be. The other put an oxygen mask on his face and hooked up monitors tracking his vital signs. The boy's eyes were wide and worried, and his breathing was about twice too fast. His family was still far away, having to travel by ground. But he remained sweetly brave, as children do more often than you'd expect.

My first instinct was that the anesthesiologist should put a stiff breathing tube into the boy's airway to fix it open before the tumor closed in. But the anesthesiologist thought this was nuts. She'd have to put the tube in without good sedation, with the kid sitting up, no less. And the tumor extended far along the airway. She wasn't convinced she could reach a tube past it easily enough.

The surgical fellow proposed another idea: if we put a catheter into the boy's right chest and drained off the fluid filling it, the tumor would tilt away from the left lung. On the phone, however, the senior surgeon was concerned that this could worsen matters. Once you have unsettled a boulder, can you honestly say which way it will roll? No one was thinking of any better options, however. So ultimately he said to go ahead.

I explained to Lee what we were going to do as simply as I could. I doubt he understood. That may have been just as well. After we'd gathered all the supplies we needed, two of us held Lee tight, and another injected a local anesthetic between his ribs, then made a slit with a knife and pushed a foot-and-a-half-long rubber catheter in. Bloody fluid poured out of the tube by the quart, and for a moment I was afraid we'd done something terrible. But as it turned out, we'd done more good than we could have hoped for. The tumor shifted rightward and somehow the airways to *both* lungs opened up. Instantly,

Lee's breathing became easier and quiet. After watching him a few minutes, so did ours.

Not until later did I wonder about our choice. It was little more than a guess about what to do—a stab in the dark, almost literally. We had no backup plan should disaster have occurred. And when I looked up reports of similar cases at the library afterward, I learned that other options did in fact exist. The safest thing, apparently, would have been to put him on a heart-lung bypass pump like the kind used during cardiac surgery, or at least to have one on standby. Talking with the others about it, though, I found that no one regretted a thing. Lee survived. That was what mattered. And his chemotherapy was now under way. Testing of the fluid showed the tumor to be a lymphoma. The oncologist told me that this gave Lee a better than 70 percent chance of total cure.

These are the moments in which medicine actually happens. And it is in these moments that this book takes place—the moments in which we can see and begin to think about the workings of things as they are. We look for medicine to be an orderly field of knowledge and procedure. But it is not. It is an imperfect science, an enterprise of constantly changing knowledge, uncertain information, fallible individuals, and at the same time lives on the line. There is science in what we do, yes, but also habit, intuition, and sometimes plain old guessing. The gap between what we know and what we aim for persists. And this gap complicates everything we do.

I am a surgical resident, very nearly at the end of my eight years of training in general surgery, and this book arises from the intensity of that experience. At other times I have been a laboratory scientist, a public health researcher, a student of philosophy and ethics, and a health policy adviser in government. I am also a son of two doctors, a husband, and a parent. I have attempted to bring all of these perspectives to bear on what I have written here. But more than anything, this book comes from what I have encountered and witnessed in the day-to-day caring of people. A resident has a distinctive vantage on

medicine. You are an insider, seeing everything and a part of everything; yet at the same time you see it anew.

In some way, it may be in the nature of surgery itself to want to come to grips with the uncertainties and dilemmas of practical medicine. Surgery has become as high tech as medicine gets, but the best surgeons retain a deep recognition of the limitations of both science and human skill. Yet still they must act decisively.

The book's title, *Complications*, comes not just from the unexpected turns that can result in medicine but also, and more fundamentally, from my concern with the larger uncertainties and dilemmas that underlie what we do. This is the medicine that one cannot find explained in textbooks but that has puzzled me, sometimes troubled me, sometimes amazed me, as I've joined the profession's ranks. I have divided the book into three sections. The first examines the fallibility of doctors, asking, among other things, how mistakes happen, how a novice learns to wield a knife, what a good doctor is, how it is that one could go bad. The second focuses on mysteries and unknowns of medicine and the struggles with what to do about them; these are the stories of an architect with incapacitating back pain in whom no physical explanation could be found, a young woman with an awful nausea that would not go away, a television newscaster whose blushing became so inexplicably severe that she could no longer function in her job. The third and final section then centers on uncertainty itself. For what seems most vital and interesting is not how much we in medicine know but how much we don't—and how we might grapple with that ignorance more wisely.

Throughout I've sought to show not just the ideas but also the people in the middle of it all—the patients and doctors alike. In the end, it is practical, everyday medicine that most interests me—what happens when the simplicities of science come up against the complexities of individual lives. As pervasive as medicine has become in modern life, it remains mostly hidden and often misunderstood. We have taken it to be both more perfect than it is and less extraordinary than it can be.

Part I

Fallibility

Education of a Knife

The patient needed a central line. "Here's your chance," S., the chief resident, said. I had never done one before. "Get set up and then page me when you're ready to start."

It was my fourth week in surgical training. The pockets of my short white coat bulged with patient printouts, laminated cards with instructions for doing CPR and using the dictation system, two surgical handbooks, a stethoscope, wound-dressing supplies, meal tickets, a penlight, scissors, and about a buck in loose change. As I headed up the stairs to the patient's floor, I rattled.

This will be good, I tried to tell myself: my first real procedure. My patient—fiftyish, stout, taciturn—was recovering from abdominal surgery he'd had about a week before. His bowel function hadn't yet returned, leaving him unable to eat. I explained to him that he needed intravenous nutrition and that this required a "special line" that would go into his chest. I said that I would put the line in him while he was in his bed, and that it would involve my laying him out flat, numbing up a spot on his chest with local anesthetic, and then threading the line in. I did not say that the line was eight inches long and would go into his vena cava, the main blood vessel to his heart. Nor did I say how tricky the procedure would be. There were "slight

risks" involved, I said, such as bleeding or lung collapse; in experienced hands, problems of this sort occur in fewer than one case in a hundred.

But, of course, mine were not experienced hands. And the disasters I knew about weighed on my mind: the woman who had died from massive bleeding when a resident lacerated her vena cava; the man who had had to have his chest opened because a resident lost hold of the wire inside the line which then floated down to the patient's heart; the man who had had a cardiac arrest when the procedure put him into ventricular fibrillation. But I said nothing of such things when I asked my patient's permission to do his line. And he said, "OK," I could go ahead.

I had seen S. do two central lines; one was the day before, and I'd attended to every step. I watched how she set out her instruments and laid down her patient and put a rolled towel between his shoulder blades to make his chest arch out. I watched how she swabbed his chest with antiseptic, injected lidocaine, which is a local anesthetic, and then, in full sterile garb, punctured his chest near his clavicle with a fat three-inch needle on a syringe. The patient didn't even flinch. S. told me how to avoid hitting the lung with the needle ("Go in at a steep angle; stay *right* under the clavicle"), and how to find the subclavian vein, a branch to the vena cava lying atop the lung near its apex ("Go in at a steep angle; stay *right* under the clavicle"). She pushed the needle in almost all the way. She drew back on the syringe. And she was in. You knew because the syringe filled with maroon blood. ("If it's bright red, you've hit an artery," she said. "That's not good.")

Once you have the tip of this needle poking in the vein, you have to widen the hole in the vein wall, fit the catheter in, and thread it in the right direction—down to the heart rather than up to the brain—all without tearing through vessels, lung, or anything else. To do this, S. explained, you start by getting a guidewire in place. She pulled the syringe off, leaving the needle in place. Blood flowed out. She picked up a two-foot-long twenty-gauge wire that looked like the

steel D string of an electric guitar, and passed nearly its full length through the needle's bore, into the vein, and onward toward the vena cava. "Never force it in," she warned, "and never ever let go of it." A string of rapid heartbeats fired off on the cardiac monitor, and she quickly pulled the wire back an inch. It had poked into the heart, causing momentary fibrillation. "Guess we're in the right place," she said to me quietly. Then to the patient: "You're doing great. Only a couple minutes now." She pulled the needle out over the wire and replaced it with a bullet of thick, stiff plastic, which she pushed in tight to widen the vein opening. She then removed this dilator and threaded the central line—a spaghetti-thick, yellow, flexible plastic tube—over the wire until it was all the way in. Now she could remove the wire. She flushed the line with a heparin solution and sutured it to his chest. And that was it.

I had seen the procedure done. Now it was my turn to try. I set about gathering the supplies—a central-line kit, gloves, gown, cap, mask, lidocaine—and that alone took me forever. When I finally had the stuff together, I stopped outside my patient's door and just stood there staring, silently trying to recall the steps. They remained frustratingly hazy. But I couldn't put it off any longer. I had a page-long list of other things to get done: Mrs. A needed to be discharged; Mr. B needed an abdominal ultrasound arranged; Mrs. C needed her skin staples removed. . . . And every fifteen minutes or so I was getting paged with more tasks—Mr. X was nauseated and needed to be seen; Miss Y's family was here and needed "someone" to talk to them; Mr. Z needed a laxative. I took a deep breath, put on my best don't-worry-I-know-what-I'm-doing look, and went in to do the line.

I placed the supplies on a bedside table, untied the patient's gown behind his neck, and laid him down flat on the mattress, with his chest bare and his arms at his sides. I flipped on a fluorescent overhead light and raised his bed to my height. I paged S. to come. I put on my gown and gloves and, on a sterile tray, laid out the central line, guidewire, and other materials from the kit the way I remembered S. doing it. I drew up five cc's of lidocaine in a syringe, soaked

two sponge-sticks in the yellow-brown Betadine antiseptic solution, and opened up the suture packaging. I was good to go.

S. arrived. "What's his platelet count?"

My stomach knotted. I hadn't checked. That was bad: too low and he could have a serious bleed from the procedure. She went to check a computer. The count was acceptable.

Chastened, I started swabbing his chest with the sponge-sticks. "Got the shoulder roll underneath him?" S. asked. Well, no. I had forgotten this, too. The patient gave me a look. S., saying nothing, got a towel, rolled it up, and slipped it under his back for me. I finished applying the antiseptic and then draped him so only his right upper chest was exposed. He squirmed a bit beneath the drapes. S. now inspected my tray. I girded myself.

"Where's the extra syringe for flushing the line when it's in?" Damn. She went out and got it.

I felt for landmarks on the patient's chest. *Here?* I asked with my eyes, not wanting to undermine my patient's confidence any further. She nodded. I numbed the spot with lidocaine. ("You'll feel a stick and a burn now, sir.") Next, I took the three-inch needle in hand and poked it through the skin. I advanced it slowly and uncertainly, a few millimeters at a time, afraid to plunge it into something bad. This is a big goddam needle, I kept thinking. I couldn't believe I was sticking it into someone's chest. I concentrated on maintaining a steep angle of entry, but kept spearing his clavicle instead of slipping beneath it.

"Ow!" he shouted.

"Sorry," I said. S. signaled with a kind of surfing hand gesture to go underneath the clavicle. This time it did. I drew back on the syringe. Nothing. She pointed deeper. I went in deeper. Nothing. I took the needle out, flushed out some bits of tissue clogging it, and tried again.

"*Ow!*"

Too superficial again. I found my way underneath the clavicle once more. I drew the syringe back. Still nothing. He's too obese, I

thought to myself. S. slipped on gloves and a gown. "How about I have a look," she said. I handed her the needle and stepped aside. She plunged the needle in, drew back on the syringe, and, just like that, she was in. "We'll be done shortly," she told the patient. I felt utterly inept.

She let me continue with the next steps, which I bumbled through. I didn't realize how long and floppy the guidewire was until I pulled the coil out of its plastic sleeve, and, putting one end of it into the patient, I very nearly let the other touch his unsterile bedsheet. I forgot about the dilating step until she reminded me. Then, when I put in the dilator, I didn't push quite hard enough, and it was really S. who pushed it all the way in. Finally we got the line in, flushed it, and sutured it in place.

Outside the room, S. said that I could be less tentative the next time, but that I shouldn't worry too much about how things had gone. "You'll get it," she said. "It just takes practice." I wasn't so sure. The procedure remained wholly mysterious to me. And I could not get over the idea of jabbing a needle so deeply and blindly into someone's chest. I awaited the X ray afterward with trepidation. But it came back fine: I had not injured the lung and the line was in the right place.

Not everyone appreciates the attractions of surgery. When you are a medical student in the operating room for the first time, and you see the surgeon press the scalpel to someone's body and open it like fruit, you either shudder in horror or gape in awe. I gaped. It was not just the blood and guts that enthralled me. It was the idea that a mere person would have the confidence to wield that scalpel in the first place.

There is a saying about surgeons, meant as a reproof: "Sometimes wrong; never in doubt." But this seemed to me their strength. Every day, surgeons are faced with uncertainties. Information is inadequate; the science is ambiguous; one's knowledge and abilities are never perfect. Even with the simplest operation, it cannot be

taken for granted that a patient will come through better off—or even alive. Standing at the table my first time, I wondered how the surgeon knew that he would do this patient good, that all the steps would go as planned, that bleeding would be controlled and infection would not take hold and organs would not be injured. He didn't, of course. But still he cut.

Later, while still a student, I was allowed to make an incision myself. The surgeon drew a six-inch dotted line with a marking pen across a sleeping patient's abdomen and then, to my surprise, had the nurse hand me the knife. It was, I remember, still warm from the sterilizing autoclave. The surgeon had me stretch the skin taut with the thumb and forefinger of my free hand. He told me to make one smooth slice down to the fat. I put the belly of the blade to the skin and cut. The experience was odd and addictive, mixing exhilaration from the calculated violence of the act, anxiety about getting it right, and a righteous faith that it was somehow good for the person. There was also the slightly nauseating feeling of finding that it took more force than I'd realized. (Skin is thick and springy, and on my first pass I did not go nearly deep enough; I had to cut twice to get through.) The moment made me want to be a surgeon—not to be an amateur handed the knife for a brief moment, but someone with the confidence to proceed as if it were routine.

A resident, however, begins with none of this air of mastery—only a still overpowering instinct against doing anything like pressing a knife against flesh or jabbing a needle into someone's chest. On my first day as a surgical resident, I was assigned to the emergency room. Among my first patients was a skinny, dark-haired woman in her late twenties who hobbled in, teeth gritted, with a two-and-a-half-foot-long wooden chair-leg somehow nailed into the bottom of her foot. She explained that the leg had collapsed out from under a kitchen chair she had tried to sit upon and, leaping up to keep from falling, she inadvertently stomped her bare foot onto the three-inch screw sticking out of it. I tried very hard to look like someone who had not just got his medical diploma the week before. Instead, I

was determined to be nonchalant, world-weary, the kind of guy who had seen this sort of thing a hundred times before. I inspected her foot and could see that the screw was imbedded in the bone at the base of her big toe. There was no bleeding, and, so far as I could feel, no fracture.

"Wow, that must hurt," I blurted out idiotically.

The obvious thing to do was give her a tetanus shot and pull out the screw. I ordered the tetanus shot, but I began to have doubts about pulling out the screw. Suppose she bled? Or suppose I fractured her foot? Or something worse? I excused myself and tracked down Dr. W, the senior surgeon on duty. I found him tending to a car-crash victim. The patient was a mess. People were shouting. Blood was all over the floor. It was not a good time to ask questions.

I ordered an X ray. I figured it would buy time and let me check my amateur impression that she didn't have a fracture. Sure enough, getting one took about an hour and it showed no fracture—just a common screw imbedded, the radiologist said, "in the head of the first metatarsal." I showed the patient the X ray. "You see, the screw's imbedded in the head of the first metatarsal," I said. And the plan? she wanted to know. Ah, yes, the plan.

I went to find Dr. W. He was still tied up with the crash victim, but I was able to interrupt to show him the X ray. He chuckled at the sight of it and asked me what I wanted to do. "Pull the screw out?" I ventured. "Yes," he said, by which he meant "Duh." He made sure I'd given a tetanus shot and then shooed me away.

Back in the room, I told her that I would pull the screw out, prepared for her to say something like "You?" Instead she said, "OK, Doctor," and it was time for me to get down to business. At first I had her sitting on the exam table, dangling her leg off the side. But that didn't look as if it would work. Eventually, I had her lie with her foot jutting off the end of the table, the board poking out into the air. With every move, her pain increased. I injected a local anesthetic where the screw went in and that helped a little. Now I grabbed her foot in one hand, the board in the other, and then for a moment I

froze. Could I really do this? Should I really do this? Who was I to presume?

Finally, I just made myself do it. I gave her a one-two-three and pulled, too gingerly at first and then, forcing myself, hard. She groaned. The screw wasn't budging. I twisted, and abruptly it came free. There was no bleeding. I washed the wound out, as my textbooks said to for puncture wounds. She found she could walk, though the foot was sore. I warned her of the risks of infection and the signs to look for. Her gratitude was immense and flattering, like the lion's for the mouse—and that night I went home elated.

In surgery, as in anything else, skill and confidence are learned through experience—haltingly and humiliatingly. Like the tennis player and the oboist and the guy who fixes hard drives, we need practice to get good at what we do. There is one difference in medicine, though: it is people we practice upon.

My second try at placing a central line went no better than the first. The patient was in intensive care, mortally ill, on a ventilator, and needed the line so that powerful cardiac drugs could be delivered directly to her heart. She was also heavily sedated, and for this I was grateful. She'd be oblivious to my fumbling.

My preparation was better this time. I got the towel roll in place and the syringes of heparin on the tray. I checked her lab results, which were fine. I also made a point of draping more widely, so that if I flopped my guidewire around by mistake again, I could be sure it wouldn't hit anything unsterile.

For all that, the procedure was a bust. I stabbed the needle in too shallow and then too deep. Frustration overcame tentativeness and I tried one angle after another. Nothing worked. Then, for one brief moment, I got a flash of blood in the syringe, indicating I was in the vein. I anchored the needle with one hand and went to pull the syringe off with the other. But the syringe was jammed on too tightly, so that when I pulled it free I dislodged the needle from the vein.

The patient began bleeding into her chest wall. I applied pressure the best I could for a solid five minutes, but her chest still turned black and blue around the site. The hematoma made it impossible to put a line through there anymore. I wanted to give up. But she needed a line and the resident supervising me—a second-year this time—was determined that I succeed. After an X ray showed that I had not injured her lung, he had me try again on the other side with a whole new kit. I still missed, however, and before I turned the patient into a pincushion he took over. It took him several minutes and two or three sticks to find the vein himself and that made me feel better. Maybe she was an unusually tough case.

When I failed with a third patient a few days later, however, the doubts really set in. Again, it was stick, stick, stick, and nothing. I stepped aside. The resident watching me got it on the very next try.

Surgeons, as a group, adhere to a curious egalitarianism. They believe in practice, not talent. People often assume that you have to have great hands to become a surgeon, but it's not true. When I interviewed to get into surgery programs, no one made me sew or take a dexterity test or checked if my hands were steady. You do not even need all ten fingers to be accepted. To be sure, talent helps. Professors say every two or three years they'll see someone truly gifted come through a program—someone who picks up complex manual skills unusually quickly, sees the operative field as a whole, notices trouble before it happens. Nonetheless, attending surgeons say that what's most important to them is finding people who are conscientious, industrious, and boneheaded enough to stick at practicing this one difficult thing day and night for years on end. As one professor of surgery put it to me, given a choice between a Ph.D. who had painstakingly cloned a gene and a talented sculptor, he'd pick the Ph.D. every time. Sure, he said, he'd bet on the sculptor being more physically talented; but he'd bet on the Ph.D. being less "flaky." And in the end that matters more. Skill, surgeons believe, can be

taught; tenacity cannot. It's an odd approach to recruitment, but it continues all the way up the ranks, even in top surgery departments. They take minions with no experience in surgery, spend years training them, and then take most of their faculty from these same homegrown ranks.

And it works. There have now been many studies of elite performers—international violinists, chess grand masters, professional ice-skaters, mathematicians, and so forth—and the biggest difference researchers find between them and lesser performers is the cumulative amount of deliberate practice they've had. Indeed, the most important talent may be the talent for practice itself. K. Anders Ericsson, a cognitive psychologist and expert on performance, notes that the most important way in which innate factors play a role may be in one's *willingness* to engage in sustained training. He's found, for example, that top performers dislike practicing just as much as others do. (That's why, for example, athletes and musicians usually quit practicing when they retire.) But more than others, they have the will to keep at it anyway.

I wasn't sure I did. What good was it, I wondered, to keep doing central lines when I wasn't coming close to getting them in? If I had a clear idea of what I was doing wrong, then maybe I'd have something to focus on. But I didn't. Everyone, of course, had suggestions. Go in with the bevel of the needle up. No, go in with the bevel down. Put a bend in the middle of the needle. No, curve the needle. For a while, I tried to avoid doing another line. Soon enough, however, a new case arose.

The circumstances were miserable. It was late in the day and I'd been up all the night before. The patient was morbidly obese, weighing more than three hundred pounds. He couldn't tolerate lying flat because the weight of his chest and abdomen made it hard for him to breathe. Yet he absolutely needed a central line. He had a badly infected wound and needed intravenous antibiotics, and no one could find veins in his arms for a peripheral IV. I had little hope

of succeeding. But a resident does what he is told, and I was told to try the line.

I went to his room. He looked scared and said he didn't think he'd last more than a minute on his back. But he said he understood the situation and was willing to make his best effort. He and I decided that he'd be left sitting propped up in bed until the last possible minute. We'd see how far we got after that.

I went through my preparations: checking the labs, putting out the kit, placing the towel roll, and so on. I swabbed and draped his chest while he was still sitting up. S., the chief resident, was watching me this time, and when everything was ready I had her tip him back, an oxygen mask on his face. His flesh rolled up his chest like a wave. I couldn't find his clavicle with my fingertips to line up the right point of entry. And already he was looking short of breath, his face red. I gave S. a "Do you want to take over?" look. Keep going, she signaled. I made a rough guess as to where the right spot was, numbed it with lidocaine, then pushed the big needle in. For a second, I thought it wouldn't be long enough to reach through, but then I felt the tip slip underneath his clavicle. I pushed a little deeper and drew back on the syringe. Unbelievably, it filled with blood. *I was in.* I concentrated on anchoring the needle firmly in place, not moving it a millimeter as I pulled the syringe off and threaded the guidewire in. The wire fed in smoothly. He was struggling hard for air now. We sat him up and let him catch his breath. And then with one more lie-down, I got the entry dilated and slid the central line in. "Nice job," was all S. said, and then she left.

I still have no idea what I did differently that day. But from then on, my lines went in. Practice is funny that way. For days and days, you make out only the fragments of what to do. And then one day you've got the thing whole. Conscious learning becomes unconscious knowledge, and you cannot say precisely how.

I have now put in more than a hundred central lines. I am by no means infallible. Certainly, I have had my fair share of what we