‘You’re probably going to die tonight’

Hollywood TV millionaire Jonathan Koch was a teetotal fitness addict when he was struck down by a mystery illness. Against all expectations, he survived – but his hands were destroyed. Then a surgeon decided he was the perfect candidate for a pioneering hand transplant

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April 15 2017, 12:01am, The Times

Jonathan Koch, 49, with his new left hand, and his surgeon, Kodi Azari, 48, in UCLA hospital in December 2016

MICHAEL LEWIS

It is a beautiful hand: strong, with slender fingers and smooth skin, its nails ridgeless and pink. If you didn't know Jonathan Koch, you might not suspect that his hand previously belonged to someone else. There is a bulge where Koch's and the donor's tendons are woven together, but the mark itself doesn't catch the eye. The Y-shaped seam on his inner arm does. This scar is a stark reminder of the technical mastery that underlies a medical miracle.

In January, about three months after Koch and this hand became one, his wife, Jennifer, aims a video camera his way and asks how he is. "I feel great," he replies. To see his muscles straining under his T-shirt, it's easy to forget what he's endured. "My hand's more attractive than the hand I used to have, so I'm getting a lot of attention," he quips, adding that the transplant has earned him a few stalkers. A moment later, though, he's dead serious. "I wasn't left-handed," he says, "but I am now."

Precisely two years earlier, as the 2015 Realscreen Summit kicked off, the movers and shakers of the unscripted television world arrived in Washington DC, a bit more sober than they had been the year before. Reality TV was struggling. Jonathan Koch was under pressure. In December 2013, he and his partner, Steve Michaels, had sold their production company for north of $100 million (£80 million). They continued to run it. Deals made at Realscreen would

be key to making money. So, as the audience listened to presentations with titles such as *Pitch Perfect: What Works, What Doesn't*, *What's Real and What's Not*, it was only a matter of time before someone asked: where's Jonathan Koch?

Koch looked down at his feet, which were black. 'Wow,' he said. 'Impressive'

Koch was one of Hollywood's great closers. Whether pitching the series *How Sex Changed the World* or *The Kennedys* (which starred Katie Holmes and won four Emmys), he knew how to get a deal done. He was also an exercise addict. At 6ft 1in and 16 stone, the 49-year-old led a daily predawn workout for friends.

His story was a classic reinvention tale. Fresh out of college in 1987, Koch had driven his Toyota Celica from Pennsylvania to Los Angeles with $300. His car would be stolen two weeks later. Two decades later, he was king at creating content.

Koch was booked on the first flight from Los Angeles on Monday, January 26, 2015. But he'd woken up feeling awful. He headed not to the airport but the medical centre, where his doctor – finding no cause for his discomfort – gave him a shot of morphine and sent him on his way. At midday in LA, Koch emailed his partner. "Flying out at 2pm. Will be ready!" Koch promised. Michaels replied, "Are you dying or you feel OK?" Later Michaels wished he'd phrased his question another way.

Doped up on morphine, Koch made it to DC. The next morning, he dragged himself to his first meeting. Midway through his second, Koch looked at a colleague, Joan Harrison, and saw three of her. She insisted her boss went to A&E. A taxi dropped him off at George Washington University Hospital at 11am. His temperature was 102F.

Jonathan Koch didn't drink alcohol, didn't smoke, and hadn't tried a single recreational drug. Typically he and his fiancée, Jennifer, were in bed by 9pm. Six months before the Realscreen Summit, on a visit to Canyon Ranch, the exclusive Arizona spa, he'd been told he had the cardiovascular fitness of a top athlete. Now doctors were wondering: does he have pneumonia? Between all the tests and the worsening pain, he distracted himself with humour,

sending the CEO of a cable channel a selfie, with an IV protruding from his neck. His caption: “Conference is not going great.”

On Tuesday night, Koch was moved to the intensive care unit. His condition was a mystery. “I am really not well,” he texted Jennifer at 7.25pm. The pain was debilitating. At 2am, Dr Lynn Abell levelled with him: “Text everyone you love,” she said. “You’re probably going to die tonight.”

Jennifer booked the next flight to Washington. By the time she landed, doctors had put her fiancé into a propofol-induced coma. The next day Koch was in full-blown septic shock, his blood barely circulating. His hands and feet were blue and beginning to blister as his body pulled blood from his limbs to protect his brain and other vital organs. His immune system was in overdrive. With his extremities deprived of oxygenated blood, gangrene set in. Despite huge doses of antibiotics, her fiancé’s body “was getting ready to die”, the doctors told her. Chance of survival: ten per cent.

She searched her memory for what could have triggered this nightmare. On Sunday they’d tried a new vegan restaurant. Could he have ingested bacteria there? As Koch lay unconscious over the next two and a half weeks, he suffered terrifying hallucinations.

Jennifer and Jonathan Koch at their home in Los Angeles
STEVE SCHOFIELD

Growing up in the town of State College, the home of Penn State University, Koch had faced traumas. His dad was a charismatic salesman but, at home, he was cruel. When Koch was little, his father showed him how to tie his shoes a single time, then banished the boy to the basement until he figured it out. “I was down there for 12 hours,” Koch would say as he recounted the story later.

At 11, Koch made a secret calendar that showed how many days remained until his 18th birthday. Each day he’d put an X through another 24 hours, one beat closer to freedom.

In intensive care, doctors had performed a tracheotomy to avoid a breathing-tube infection. At one point his eyes opened, staring ahead, unseeing. “I wonder where Jonathan is,” asked his only sibling, Lisa. On the final day of his coma, he could sense the presence of all the people he’d ever known, chief among them his daughter, Ariana, 15.

Koch could feel Jennifer, too, sitting near his bed. His shallow breathing sounded like his mother’s had on her deathbed. He understood he was about to die.

In an instant, he was propelled upward like a torpedo. His first words were, “How did I get here?” Then he looked down at his feet, which were black and beginning to shrivel. “Wow,” he said. “Impressive.”

In retrospect it seems crazy that in Jonathan Koch’s condition, he boarded a flight to a reality-TV convention. But that decision arguably saved his life. No hospital in the country was better equipped than George Washington University’s to help him survive. The intensive care unit was new, and so was its Wound Healing and Limb Preservation Centre. Perhaps most crucial, when Koch was admitted, the hospital was in a trial to test a method of removing toxicity from the blood.

The reason you took such great care of yourself was not to avoid this. It was to survive it

No one knew what had caused Koch to become so sick. Sepsis isn't something you catch; it's triggered by another condition. Septic shock kills 50 per cent of those it afflicts, and those who die do so quickly. Doctors sought to discover what had thrown his system into chaos, ruling out candidates one by one. He didn't have an antibiotic-resistant staph infection or Lyme disease. He had not been exposed to the ebola virus. There was evidence that he had antibodies to the Epstein-Barr virus, which can result in chronic fatigue syndrome, but 95 per cent of adults have the virus and do not develop complications. Yes, he'd been driving himself hard, but he always did that. Doctors thought he might have a rare bone marrow cancer and gave him chemotherapy. Their strategy: treat every possibility at the same time. And it had worked. He had survived.

That March, in the hope of discovering what had caused his illness, Jonathan and Jennifer made the difficult decision to leave George Washington University to travel to the Mayo Clinic, in Rochester, Minnesota. On the day of their departure, Dr Abell, who'd always

conducted herself in a no-nonsense manner, had tears in her eyes. “I don’t understand,” he said to Abell. “Why did this happen?” Abell’s response? “Jonathan, the reason you took such great care of yourself was not to avoid this. It was to survive this.”

His time in Minnesota was rough; Koch’s limbs were in unspeakable pain. Doctors at Mayo had begun to discuss amputations.

On April 20, 2015, 85 days after he was first admitted to hospital, someone mentioned a doctor: Kodi Azari. At 48, Azari is the surgical director of the hand transplant program at UCLA, where he’s worked since 2008. The first hand transplant to achieve prolonged success was performed 18 years ago in Louisville; by 2015, fewer than 85 procedures had been undertaken worldwide. (In Britain, a specialist unit at Leeds General Infirmary has since 2016 been undertaking NHS-funded hand transplants.) Azari is one of the lead surgeons for the first double-hand transplant and the first arm transplant performed in the US. Not for nothing has he made the hand his life’s work. The human hand is an engineering marvel. There is no more impressive example of functional anatomy. The fingers have more nerve endings than almost any other part of the body.

In 2015, Azari was laying the groundwork for UCLA's second hand transplant. The doctor had some hypotheses he wanted to test, provided he could find a patient with the ideal requirements: excellent health, enormous self-discipline, a positive attitude, and – rarest of all – a limb that needed to be replaced but had not yet been amputated. Azari knew this was a long shot: most hand transplant candidates have been injured in accidents or in battle, when a catastrophic event forces an emergency amputation. These procedures are aimed at minimising suffering and are usually carried out to facilitate future prosthetic use. Generally that means the arm is severed closer to the elbow than the wrist, and the nerves and tendons are trimmed back and tucked inward to lessen discomfort. That creates challenges, however, if a transplant is attempted later. All those tucked-in nerves and tendons tend to merge over time into a jumble of tissues that is difficult to connect to a new hand with precision.

Wouldn't it be great, Azari thought, if a transplant recipient's arm could be amputated in a way that prepped it specifically to receive a new limb? How much more quickly would a patient recover if each tendon, nerve, artery and vein were left in place and marked – labelled, like so many coloured speaker wires, to be hooked up to a matching apparatus? How much more functionality would the patient gain, and how rapidly would he or she gain it? Azari

believed this fantasy patient would awaken post-op, look at the new hand, and be able to move the fingers right away.

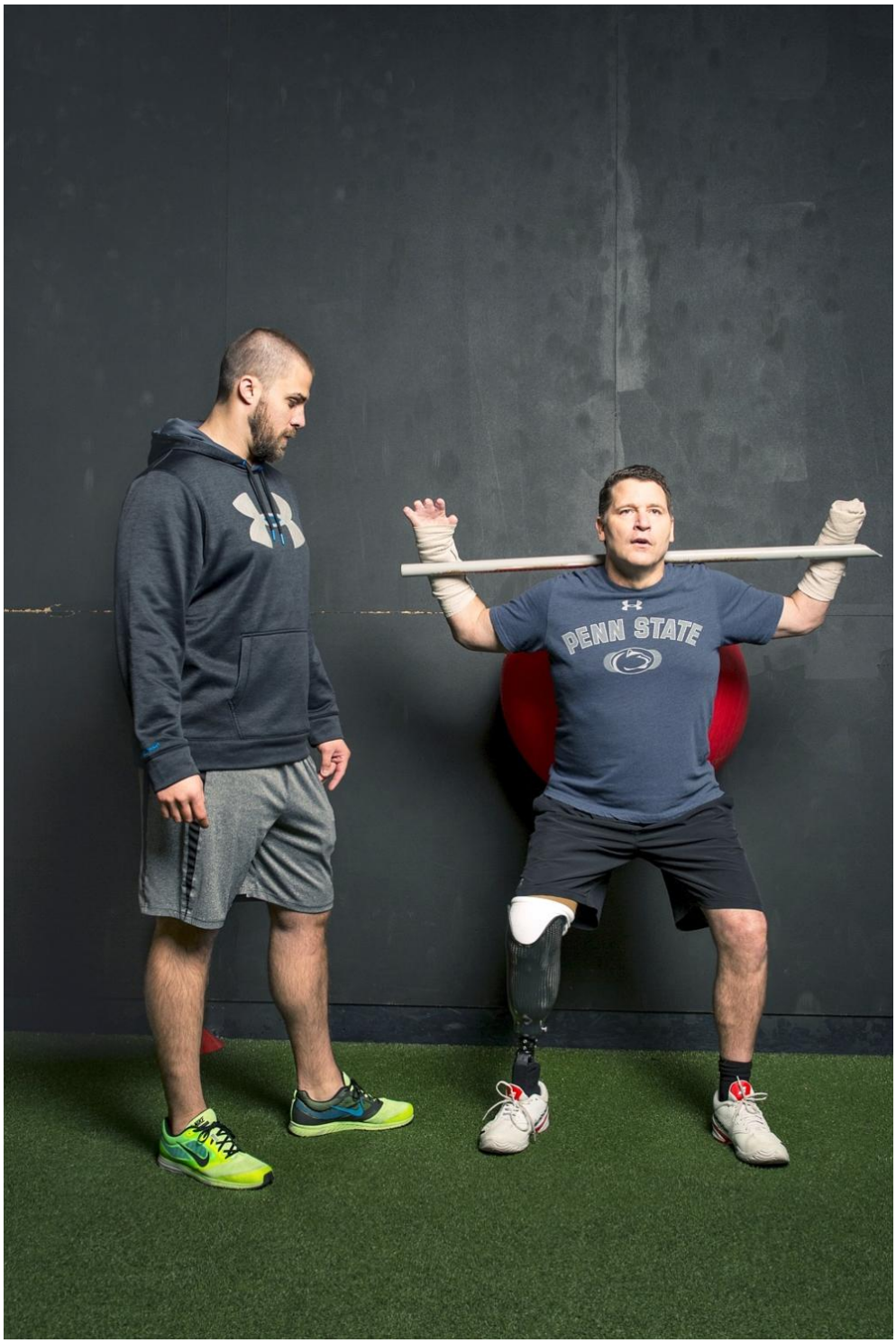
Born in London, Azari lived in Iran until he was 11, when revolution forced his family to flee. His father had been the managing director of an oil company, and their assets had been seized. The family arrived in Connecticut with nearly nothing. Once the boy had dreamed of being a fighter pilot; in America he understood he must bring respect and security to his family. To his Iranian parents that meant pursuing one of two professions: engineering or medicine.

Azari wasn't wild about the choices, but as he learnt about his new country through a series of jobs – delivering newspapers, washing dishes in restaurants, painting sewer pipes – he found a way to make peace with his family. "I told them a white lie. I said, 'OK, I'll be a doctor' – just to get them off my back," he says.

Then a family friend began sending Azari articles about Dr Thomas Starzl, a researcher at the University of Pittsburgh who's seen as the father of modern transplantation. Starzl had performed the first human liver transplant in 1963 and later the first simultaneous heart, kidney and liver transplant, all while working on technical advances in organ procurement and preservation.

Little by little, Azari's white lie became the truth. After high school, he would train, as he likes to say, "for 18 years straight" to become a surgeon. In the years since completing his first hand transplant at UCLA, Azari had been waking up at night, thinking about how to improve on the next. He visualises efficiency. "I have this saying that there are good fast surgeons and bad fast surgeons but no good slow surgeons. What makes you slow is that you don't have a game plan you know in your mind." Azari had a game plan. Now all he needed was the right patient.

For the Kochs, it seemed too much to hope for: a top-flight hand transplant expert in LA. A week after they returned home from Minnesota, Koch, Jennifer and her dad, Tom, were sitting across from Azari in a consultation room at UCLA Medical Centre. Dr Francis Cyran, an orthopaedic surgeon, was also there. Koch, bleary from painkillers and his feet unable to bear any weight, sat in a wheelchair.



Koch with trainer Scott Zeller, 2015
MICHAEL LEWIS

Azari set about the sensitive task of examining his patient, both body and mind. He started with Koch's left hand, which was

completely ruined, with a charred-looking exterior except for a tiny patch of palm. The right hand was better off; while the fingers and thumb were almost entirely blackened, the rest seemed like it could be saved. Then there were the feet. Damage to the left was mostly confined to the toes, but the right looked as if it had been wholly fashioned out of charcoal. “Get rid of it,” Azari said. “It’s a no-brainer. It isn’t salvageable.” Koch and Jennifer weren’t ready to accept that, but something about Azari’s manner – he was straightforward, gentle, kind around the eyes – calmed them. “I will make you this promise,” Azari told them. “I will not do anything to make you worse.”

Finally, Jennifer inquired about bathing. At Mayo they’d been told that Koch’s extremities could not get wet. Without skipping a beat, Azari told Koch to “go ahead and shower”. Azari reassured them that being clean would help Koch feel like himself, and that, after all, was their ultimate goal. “We knew immediately,” Jennifer wrote in her notebook, “that these were our doctors.”

The couple were impatient. “They’re like, ‘OK, we’re ready. Let’s do the hand transplant. When are you going to list us?’” Azari tells me. He loved their enthusiasm but advised them to slow down. There was more healing to be done. “You need to make sure that you’ve got all these necrotic tissues off and that we’ve got you

tuned up," Azari said, "and as healthy as possible. I even want you to walk." Azari admits that at first he wondered whether Koch might be too good to be true. "I thought, 'He can't be for real. This is all a show for me.' But I set all these goals for him, and he met them all."

After returning home, Koch and Jennifer had settled into a routine. Every day they'd unwrap his hands and feet, clean them and rewrap them. Mundane tasks became a round-the-clock team effort: eating, holding water bottles to his lips, getting to the bathroom, driving to doctors' appointments. Every day, too, Koch would work out with Scott Zeller, a 6ft 7in, 19 stone trainer.

Koch was determined to get his heart rate up. Because he couldn't put any weight on his withered feet and couldn't grasp dumbbells, he used Zeller's body as resistance, pressing his thighs or shoulders against him. Withdrawing from morphine, he'd do a set of exercises, then drift into unconsciousness. Zeller would wake him when his rest period was over.

Exercise buoyed Koch. Soon work would do the same. In June 2015, he began hosting meetings with colleagues at his house. One took place right after he'd endured a session with a vascular surgeon who believed that his right foot might still be saved if she

regularly scraped away infected tissue – a procedure called debridement – to allow the healthy tissue underneath to heal. On this day, though, it was as if “she started amputating my foot without anaesthesia, a bit at a time”, he said.

My left hand was giving me so much pain, I couldn’t wait for them to cut it off

Once the toes on his left foot looked ready to auto-amputate (a natural occurrence by which the body sheds dead appendages), friends started a pool, betting when it might happen. On June 23, 2015, determined to save as much healthy tissue as possible, Azari amputated Koch’s left hand and all but about an inch of each finger on his right hand. The surgery, designed to prep him to receive a transplanted limb, was everything the doctor had imagined. Severing the left hand closer to the wrist than the elbow, Azari kept all the nerves and tendons long and extended, which would give him plenty to work with later. Then he stitched them together and attached them to the stump of bone to keep them from retracting. If a hand donor was ever found, Koch would be ready.

Oddly, losing his left hand didn't faze Koch. It had been such a source of pain, its absence brought only relief. "I couldn't wait for them to cut it off," he said.

There was much to do to prepare for the transplant. As part of a clinical trial, Koch had to undergo physical and psychological tests. Then there was the challenge of finding a suitable match in terms of size, pigment, skin tone and hair pattern. The closer the match, the easier it is for a patient to incorporate a new limb into his or her life.

On August 17, 2015, Koch and Jennifer were married in a ceremony in their backyard. The next day Cyran amputated Koch's right leg midway between his knee and his ankle and snipped off the necrotic toes that remained on his left foot. Koch had tried to be funny about the horror of watching parts of himself disappear, calling himself "Mr Potato Head". But the loss of his foot hit hard. "You've got to know when to wave the white flag and move on," he told me, already readjusting even as he acknowledged partial defeat. "The hardest part for me has been in the period of subtraction. This is the beginning of the period of addition."

Six weeks after his foot surgery, Koch slipped while transferring his weight from his wheelchair. As he lost his balance, his brain

got confused. “It said, ‘Don’t worry, you’ve got that other foot. Just bring her on down!’” But of course, his right foot was no longer there, so he broke his fall with the not yet healed stump that remained. When Azari heard what had happened, he was stern – Koch could have bled to death. “You can’t fall once I do the transplant,” Azari warned. Even as Koch joked – “Jennifer pushed me over!” – he also understood that it was time to learn how to walk. Two weeks later, once his right leg had sufficiently healed, he was fitted for his first prosthetic; he walked right away. Soon Koch would upgrade to a bionic contraption that could be adjusted to accommodate whatever type of movement he needed to do. He’d also have a prosthetic for running. “Eventually I’ll have a tennis leg and a running leg and a special tuxedo leg for the Emmys,” he joked. “We’re still working on my sex leg.”

Azari was hard at work as well. Experience had taught him not to get cocky. “The clock is your enemy,” he explains. “Hand transplants throw you curveballs. They’re never as you expect. Never. There are huge bumps in the road that can add extra time – things you didn’t account for or changes in plan. And there is no cookbook of how to do it.” So like a chef trying out a complicated dish before serving it to patrons, Azari and his team practised Koch’s surgery several times in the laboratory.

Then, procuring a donor hand for a full-on test run, he assembled a prestigious group of 13 surgeons and transplant medicine physicians whose mind-sets were as vital as their skill sets. A hand transplant is a collaboration, he explains; egos have to be kept in check. Azari's eyes well up when he thinks about the members of the team. "They came from competing organisations that often don't get along. They're usually trying to take each others' patients," he says, noting that because this was a clinical trial, nobody would get paid and everyone would have to reschedule for-profit procedures if they were to participate.

Hand transplants throw you curveballs. They're never as you expect. There are huge bumps in the road

Two months later Koch's name was formally added to the transplant recipient list, which meant the surgery could happen at any time. He and Jennifer would wait another seven months to get the call. On October 24, 2016, a donor candidate was found who shared Koch's blood type and had a hand that matched his. Azari had a good feeling.

UCLA called Koch to confirm that he was healthy. If he had a cold, there wasn't any point in asking the donor's family for the hand. In the transplant world, asking for a hand is more fraught than asking for an internal organ. The hand is so personal, so visible, so central to identity. The procurement team's concern was this: if a family believed the removal of a hand would disfigure their loved one, they could refuse to donate any organs. So while the hand that had been located for Koch seemed perfect, nobody approached the donor's family until the recipient answered the phone. At 7pm, Koch reported that, yes, he was healthy. The donor's family also said yes. The surgery was a go.

The next day Koch walked into the UCLA Medical Centre at 9.45am. Azari met him with a hug and a promise: "We're going to do this." Azari felt that Koch, with whom he'd been in near-constant contact over 19 months, was practically family – "An expensive family member," the surgeon told me. "I've had to up my texts to unlimited!" As Koch went to be prepped for surgery, Azari and his team hit the road, heading to another California hospital. It was time to pick up Koch's new hand.

Because of confidentiality agreements, nothing about the identity of the donor can be made public. When Azari arrived, the donor was on life support, and the doctor had the rare opportunity to meet

the man's brother and his pastor. Azari was overcome with emotion. In the operating room, where the hand and other organs were to be removed by several surgical teams, the entire staff took a moment to say a prayer of gratitude.

While Azari prayed, Koch was started on an anaesthesia drip. At 2.58pm, Azari texted Jennifer. "All is going well," he wrote. "We have left the donor hospital en route to UCLA."

As it happened, President Obama was in Los Angeles that day. Would the ensuing traffic blockades delay delivery? This was more than a potential inconvenience. The longer a hand goes without blood flow, the higher the risk of deterioration. A helicopter was put on standby but wasn't needed; Azari and his team, with their cargo tucked in an ice chest, encountered little traffic.

At 3.32pm, the first cut was made to prepare Koch's arm. All the components were tagged and marked for easy access. Azari arrived within the hour and joined his team. The first curveball came right away. The doctors had planned to sever the radius and ulna bones at about 11cm above the wrist.

But after opening up Koch's arm, preserving more bone seemed possible. Even though the radius and ulna showed some

deterioration, the surgeons thought they could repair them by scooping out the sick parts and packing them with healthy bone. This approach might enable the arm to heal better and have more range of motion, but there were no guarantees.

The surgeons went around the room and came to a unanimous decision: preserve another 7cm of each of Koch's bones, affixing the hand just 4cm above the wrist. The change could have created a delay, because now the titanium plates being used to join the donor's and recipient's bones were the wrong kind. But Azari had a representative from the plate manufacturer on site, and replacements were quickly found.

Tick, tick, tick. They were just a few hours in, with at least a dozen more to go. Next, the team stitched a few key tendons together. Then, working from the inside out, the doctors moved on to the arteries and veins.

Here came the second curveball. Because of the gangrene and the lack of use, Koch's veins and arteries were very small – "like chives", Azari says. They were also tough with scar tissue, which made stitching them together difficult. As the team continued repairing the musculature of the arm, pulling it more tightly

together, the arteries and veins they'd attached early on began to protrude, like a loop of extra yarn.

The surgeons had expected this. Plastic surgeons always leave more of everything than they think they'll need on the first pass because the excess can always be trimmed, and it's harder to add more later. Various tendons were similarly tightened, particularly in Koch's first, middle and ring fingers. Azari and his team would set the extensor tendon tension, then decide whether it was too loose or too tight, which would affect function and range of motion.

"You have to set the balance precisely, and we went back and did these three tendons many times until we got them right," he says. The tendons of the arm, meanwhile, were woven into one another over a 3in span to maximise strength and guard against tearing (the resulting bulge will never go away).

At 11.01pm, after the doctors had removed the tourniquets and clamps, Koch's new hand went from white to pink to red. The fullness – or turgor – returned to the tissue, and the pulse began to pound. The team posed for a picture.

For the next several hours the surgeons worked to complete repairs on the remaining tendons. At 7.07am – 16 hours after the operation began – Azari's team were closing and stitching. That took nearly two hours, in part because Azari was determined that everything should look "perfect". ("Jennifer is going to drive me nuts if it's not," he says fondly.) More than once the surgeons tied the outermost stitches, only to reopen them to trim away a little more skin – "Just like a tailor would," Azari says. The official stop time: 9.09am. They'd been at it for 17 hours, 36 minutes.

Jennifer arrived at the hospital an hour later. "Move any finger. Move your thumb," she told Koch. Kodi Azari walked into Koch's hospital room and was met with a thumbs-up.

Azari talks about his gratitude to his employer, which he lauds for "believing in something and pushing the frontiers". But the frontiers don't come cheap. The total cost of Koch's transplant and follow-up care is impossible to measure, but past procedures have cost about $1 million. Private insurers don't cover hand transplants because they want proof that a transplant benefits a patient more than a prosthetic. That leaves pioneering surgeons in a chicken-and-egg situation. "If nobody pays for it, you can't get the numbers to be able to give that proof," Azari says. The result: "If the institutions don't believe in this, then this whole field will die."

The anti-rejection drugs Koch will take for the rest of his life were initially administered at high doses, making him feel “crawly and hot”. And he had limited feeling because nerves take months to grow in. Still, during Koch’s 15 days at UCLA, he picked up a tennis ball and squeezed it. He grabbed a water bottle, brought it to his lips, and wiped his mouth with the back of his new hand.

One day Dr Mike Seneff, director of George Washington University’s ICU, came to visit. “Is it right Jonathan had a 90 per cent chance of dying?” Jennifer asked him. “Yes,” Seneff said, turning to his former patient. “I’m 61, and you are the sickest person I’ve ever seen walk out of a hospital.”

So what made Jonathan sick? He will never know for sure. When we meet at his home, with its views of the Santa Monica mountains, Jonathan says the consensus is that the Epstein-Barr virus, combined with stress, may have triggered “a 1 in 20 million event,” he says. “For some reason my immune system encountered a formidable foe, and instead of trying to save me, it tried to kill me.”

He can never eat sushi again due to the risk of bacteria in raw fish. He must wash his hands constantly. He can’t eat grapefruit, because it impedes the absorption of some medications, and he

must be for ever vigilant about looking for signs of organ rejection. It could happen at any point.

But just five months postsurgery, he is teaching himself how to play tennis again, holding the racket with his new left hand.