Orthopedic Surgeon Uses New Technique To Save Three-Year-Old's Arm

When Mark Blinder was diagnosed with a rare bone cancer, doctors at Lucile Packard Children's Hospital gave his parents three agonizing options: amputate the affected arm at the shoulder, irradiate the tumor and risk a second malignancy, or try a limb-preserving surgery that had never been attempted in a toddler.

Nearly a year later, Mark, now four, is thriving with a surgically implanted artificial humerus inside his cancer-free right arm. He's believed to be the first small child ever to receive a high-tech, telescoping prosthesis to replace the entire upper arm bone.

“This was a very unusual and challenging case,” said orthopedic surgeon Lawrence Rinsky, MD, who implanted the custom-made, one-of-a-kind artificial bone he also helped design. “Little children with humerus tumors have very few limb-sparing options,” added Neyssa Marina, MD, the pediatric oncologist who oversaw Mark's chemotherapy before and after surgery.

Rinsky and Marina aimed for a first-of-its-kind treatment that would cure Mark's cancer, preserve his hand and allow his arm to keep growing. Designing and implanting an artificial humerus bone that would grow with Mark had obvious advantages over radiation, which would have killed the bone's growth plates, or amputation. But the unconventional strategy came with no guarantees.

The prosthetic bone had to be small enough to fit in a three-year-old's arm, strong enough to last a lifetime, and expandable to allow for Mark’s growth. Balancing these demands presented a significant engineering challenge. On top of that, because Mark's entire humerus had to be removed, the prosthesis could attach only to soft tissue.

Most bone prosthetics replace half of a bone and are cemented to healthy bone; Rinsky had to find another way to hook up this implant. Even when the design was finalized with Indiana-based prosthetic manufacturer Biomet, Inc., Rinsky wasn't sure the surgery would work. Mark's parents felt trepidation, too.

“It was hard because if we had chosen just radiation, no surgery, that would not have been as physically painful for him,” his mother Alla said.

They first realized something was wrong when, in April 2008, Mark complained of severe pain in his right arm, hand and wrist. After his July 2008 diagnosis with a rare bone tumor called Ewing's sarcoma, Mark began chemotherapy. The medications helped, as the pain subsided and Mark began using his arm normally. But chemotherapy alone wouldn't vanquish the tumor.

So, early on December 4, 2008, Mark was wheeled into the operating room. Rinsky and his team, encased in space suit-like outfits to reduce infection risk, worked with utmost care. “The surgery involved taking out the entire bone without touching it,” Rinsky said. The bone had cancer cells on its surface, which could easily have spread to surrounding healthy tissue. “It was like carving out a peach pit without ever touching the pit, staying in the pulp.” Once the cancerous bone was out, Rinsky implanted the artificial bone. The prosthesis had a piece of Dacron fabric at the top, which he sewed to soft tissue in Mark's shoulder. At the elbow, Rinsky saved Mark's ligaments and placed those around the prosthesis as best he could. Then he started sewing up Mark's arm. “Dr. Rinsky came out of the operating room and said, “The prosthesis fit perfectly fine, he is doing great,'" remembered his father Gene.

Soon, there was more good news: Mark's tumor was confined to the bone that had been removed, and its malignant cells were dead, killed by chemotherapy. He spent a month healing from surgery, then received more chemotherapy to reduce the chance the cancer would return. He’ll have three to four minor surgeries over the next several years, in which Rinsky will make a small incision at the shoulder and use a few turns of a screwdriver to lengthen the implant as Mark grows.

Meanwhile, Mark is gradually re-learning to use his right hand and arm. He's moving his right wrist and fingers, can pick up small objects, and is receiving physiotherapy to rebuild strength and flexibility in his elbow and shoulder. Although Mark won’t ever regain full function in these joints, he's using the arm more each day.

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