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Battery Power to Power a Horse

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IMPLANTING a pacemaker is a routine procedure in human medicine and there are millions of people who owe their lives to tiny battery packs placed just beneath their skin. In veterinary medicine pacemakers are sometimes used to help dogs which have heart problems. And now it appears that pacemakers also have a place in large animal medicine.

Bucky, a big brown American Quarterhorse is living proof. The eight-year old gelding, an active, alert animal has a permanent pacemaker and he is thriving, thanks to the efforts of Dr. Virginia Reef, a cardiologist at New Bolton Center. "When the horse was given to us last November he could hardly walk and would faint at the slightest exertion," explained Dr. Reef. "His weight was down to 1,200 lbs. and he was scarred from his many falls."

The horse had been trained as a hunter and competed at horse shows. "About a month before we saw him here, he began having fainting spells," said Dr. Reef. "At first they happened a couple of times a week, then they increased in frequency to several times a day."

Bucky's problem was diagnosed as an arrhythmia caused by a heartblock. Electric impulses which cause a regular heart beat, could not pass through his heart muscle; this caused a slow and irregular beat. "His heart beat only ten

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times a minute," said Dr. Reef. "The normal rate for a horse is 32 to 40 beats a minute, though the heart rate of athletic horses can be as slow as 26 to 30 beats. Ten beats were just not enough to keep such a big animal going and he fainted."

Electrocardiographic examination revealed that Bucky had an inflammation of the AV node and that the block was located there. He was given anti-inflammatory drugs and his condition improved. When treatment was stopped, the arrhythmia reoccurred and was more severe. The drug regimen was resumed and his condition improved only to worsen even though the horse was still receiving the medication. "We got his heartbeat up to 30 beats a minute but we could never restore a normal rhythm" said Dr. Reef.

She then decided to fit Bucky with a temporary pacemaker. An electrode was inserted through the jugular vein into the right ventricle and connected to a battery pack. No improvement was noted. "A horse's heart is very big, larger than a cow's and the chambers are vast," she said. "The electrode was floating in the chamber but it did not make contact with the walls, so the impulse could not get to the muscle."

Another approach was tried. This time Dr. Reef used a bipolar electrode which had four tiny barbs at the end. Once again a catheter containing the wires and the electrode was fed through the vein. The barbs attached the electrode to the tip of the right ventricle, into the tissue. The wires were connected to a lithium battery which is 5 cm x 4½ cm x 1 cm, slightly larger than a Zippo lighter. "The equipment was donated by Pacesetters, Inc., and Jack Oliver, Ph.D., a member of the firm, helped us with Bucky," she said. "When the device was originally developed he had tested it in dogs and cows. We had to use the longest catheter available, 85 cm, and it was barely long enough."

Initially the battery was placed under the skin at the base of the neck. After a few weeks it became evident that the skin over the pack was dying, so another place had to be found for the powerpack. This time it was inserted under a muscle at the base of the neck. An extension wire had to be attached to make the connection between the wires and the pulse generator. By placing the battery under the muscle the veterinarians had attached it firmly to the horse's body. Changing the device will be a little more involved, though the procedure will not be necessary for five years.

Bucky's heart now beats 45 times a minute. It is faster than normal but it is the slowest speed the pulse generator can be programmed for. The equipment was developed for humans who have a higher heart rate than horses. "We could change the heart rate without taking the battery out," said

Dr. Reef. "But we wouldn't want to do it, it is fast enough."

Since the pacemaker has been in place, it hasn't missed a beat. Bucky's general health improved within three to four days after the surgery. The fluid disappeared from his lungs and his kidneys began to function normally. Now he is a picture of health and the only thing that distinguishes Bucky from other horses is the slight bulge at the base of his neck; one has to look closely to detect it.

While vigorous and active, the horse cannot resume his career as a hunter. The heart rhythm is at a fixed rate and cannot increase to meet the demands of rigorous exercise. "There is a new pacemaker which increases the number of beats as the need arises, but it is quite expensive, and we are working with donated equipment," Dr. Reef said. She explained that a pacemaker has a limited application in horses. It can be used to correct arrhythmias caused by disease, as in Bucky's case, but it cannot help in the case of a congenital defect, such as ventricular septal defect, the most common congenital heart problem seen in horses.

She also pointed out that a pacemaker is not needed for arrhythmias frequently seen in race horses. "These active horses often slow down a little, perhaps by 20 to 30 seconds over a distance. When they are examined it is found that they have atrial fibrillation. This can be treated with drugs and in most cases the animal returns to normal and resumes its racing career." She said that the heart of a normal horse is so large that arrhythmias develop easily even though the heart is healthy.

Pacemakers, as Dr. Reef sees it, can be vital in saving valuable mares or stallions with arrhythmias that cannot be corrected through drug treatment. "With a pacemaker these animals can lead normal reproductive lives. The procedure is simple and the animal can be saved."

Bucky, the only horse at the moment with a permanent pacemaker, has earned his place in the annals of veterinary medicine. He will move to a farm in Chester County to lead a quiet life in the pasture. Forgotten are the fainting spells, the scars are healed and he is once again a happy, active Quarterhorse, thanks to a device which weighs just a few ounces, yet is capable of powering 1,400 lbs. of gleaming horseflesh.

Dr. Reef came to New Bolton Center in 1979 after receiving her D.V.M. degree from Ohio State University. She completed an internship and a residency at the School and is now a lecturer. Cardiology is her specialty and she has a great interest in exercise physiology.

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