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XENOTRANSPLANTATION OF THYROCYTES INTO THE VASCULAR BED

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Xenotransplantation is defined as any procedure involving the transplantation, implantation, or infusion into a human recipient of live cells, tissues, or organs originating from a animal. Examples include the transplantation of xenogeneic hearts, kidneys, or pancreatic tissue to address organ failure, the implantation of neural cells to slow the progression of neurodegenerative diseases, and the administration of human cells previously cultured with live animal antigen-presenting cells. This approach was developed to alleviate the persistent shortage of donor organs. In the context of treating severe hypothyroidism, xenotransplantation of thyrocytes aims to offer an unlimited and readily accessible source of transplantable tissue, thereby circumventing the limitations associated with human donor availability. Although human-to-mouse models have demonstrated successful maintenance of functional thyroid tissue, including follicular organization and thyroglobulin production, in immunodeficient recipients, immune rejection continues to pose a significant obstacle.

This study tested whether transplanting rabbit thyroid cells inside small plastic capsules could cure hypothyroidism in dogs. Sixteen dogs had their thyroid glands surgically removed, which was confirmed through blood tests and special scans showing no thyroid activity remained. The dogs then showed clear signs of low thyroid hormone levels. To prepare the transplant material, the researchers took thyroid tissue from unborn rabbits in their final stage of pregnancy. In the lab, they used enzymes to break the tissue down into individual cells. These cells were then placed into tiny plastic capsules about half a centimeter wide and three centimeters long. The capsules had pores just large enough to let thyroid hormones pass out but small enough to keep the dogs' immune cells from getting in and attacking the rabbit cells. The capsules were surgically sewn into the inner wall of a major artery. In eleven dogs, the capsule went into the main belly artery, and in five dogs, it went into the leg artery. To place the capsule, surgeons made a small cut in the artery, slipped the capsule inside, and stitched it to the vessel wall using a patch made from the dog's own vein. The dogs were followed for six months. Blood tests showed that thyroid hormone levels returned to normal within three weeks after the transplant and remained stable throughout the entire six-month period. At various time points — 7 days, 14 days, 30 days, and at three and six months — the researchers removed samples of the capsules along with the surrounding artery to examine under a microscope. They found that the rabbit thyroid cells had survived, formed organized structures resembling normal thyroid tissue, and even developed their own blood supply. Importantly, there was no sign that the dogs' immune systems had rejected the transplanted cells. Scans done at three and six months using a radioactive tracer confirmed that the transplanted cells were actively producing and releasing thyroid hormones. The results were the same whether the capsule was placed in the belly artery or the leg artery. This experiment shows that encapsulating thyroid cells from another species and implanting them into an artery can restore normal thyroid function for at least six months without requiring daily medication or drugs to suppress the immune system. The study was done in a limited number of dogs, so further research is needed to confirm long-term safety and whether this approach could work in humans. Nevertheless, the findings offer a promising step toward a potential alternative to lifelong daily hormone pills for people with hypothyroidism

Xenotransplantation of encapsulated fetal rabbit thyrocytes into the abdominal aorta or femoral artery of thyroidectomized dogs successfully restored euthyroidism. The transplanted cells exhibited both histological and functional integration, with no signs of immune rejection. These findings support the feasibility of using encapsulated xenogeneic thyrocytes as a potential treatment for hypothyroidism. Further research is required to evaluate the long-term efficacy and safety of this approach in larger animal models and, eventually, in human clinical trials.