

Xenotransplantation- A promising clinical technology

POORVA GHOSH, NEHA SAWANT, B.A. AGLAVE AND M.O. LOKHANDE

Accepted : March, 2009

Key words : Chlorococcalean algae, Associate plants, Bankura district.

Xenotransplantation (xeno from Greek meaning “foreign”) is the transplantation of living cells, tissues or organs from one species to another such as pigs to humans. Such cells tissues or organs are called ‘xenografts’ or ‘xenotransplants’. The term allotransplantation refers to a same species transplant.

The re-emergence of xenotransplantation as a therapeutic option for the hundreds of thousands of people dying each year of heart, kidney, liver, and lung failure has raised ethical, scientific and social questions. End-stage organ failure is one of the most important public health problems facing the world today. Heart failure, for example, kills four times as many people as does HIV infection and three times as many people as does breast cancer. It is a disease with an increasing incidence, and the cost of taking care of affected patients is 8 to 35 billion dollars each year. The single most effective theory for it is transplantation.

Because there is a worldwide shortage of organs for clinical implantation, about 60% of patients awaiting replacement organs die on the waiting list. Recent advances in understanding the mechanisms of transplant organ rejection have brought science to a stage where it is reasonable to consider that organs from other species, probably pigs, may soon be engineered to minimize the risk of serious rejection and used as an alternative to human tissues, thereby possibly ending organ shortages.

Organ procedures, some of which are being carefully investigated in early clinical trials, aim to use cells or tissues from other species to treat life threatening and debilitating illnesses such as cancer, diabetes, liver failure, and Parkinson’s disease. If vitrification can be perfected it could allow for long-term storage of xenobiotic cells, tissues and organs so they would be more readily available for transplant.

There are only a few published successful

xenotransplant procedures. Some patients who were in need of liver transplants were able to use pig livers until a proper donor liver was available.

However, there are many challenges lined up in the way of success of effective xenotransplantation. Immune rejection remains the biggest challenge for xenotransplantation. The problem exists even for human to human transplants, but is more serious for transplants from different species. Nearly all mammalian cells have markers which enable the immune system to recognize them as being foreign. The more different the genetic code between the donor and the recipient, the greater the difference between the self marker and foreign marker. Some companies are currently developing transgenic animals such as pigs, that produce human markers to try and lessen the chance of rejection.

Another problem of xenotransplantation is the potential for infectious diseases to spread from donor animal, which is called ‘xeno zoonosis’. One example is that of porcine endogenous retroviruses (PERVs) which are viruses within pigs that pigs are immune to but, can infect isolated human cells in cell culture. Also, the physiology of the donor and the recipient should match which, is proving to be a problem as, sizes of organs differ from species to species. In addition, there are several other ethical issues with xenotransplantation that should be taken into consideration. These are issues such as use of animals in the laboratory, genetic alteration of animals religious and individual beliefs, public education and informed consent complexities for research subjects.

Potential animal donors for xenotransplantation first selected were non-human primates as genetically they are the closest to humans. Chimpanzees were originally considered as the best option available due similar size of organs, and good blood type compatibility. But, they are listed in the endangered list, this option was not feasible. Baboons are more readily available, however they are not practical as potential donors due to their smaller size and infrequency of blood group ‘o’. Pigs are currently thought to be the best candidates for organ donation. Current experiments use pigs as organ donors and baboons as human models.

In future, clinical xenotransplantation may achieve its targeted goal of extended graft survival. The successes

Correspondence to:

B.A. AGLAVE, Department of Biotechnology, Institute of Life Sciences, H.P.T. Arts and R.Y.K. Science College, NASHIK (M.S.) INDIA

Authors’ affiliations:

POORVA GHOSH, NEHA SAWANT AND M.O. LOKHANDE, Department of Biotechnology, Institute of Life Sciences, H.P.T. Arts and R.Y.K. Science College, NASHIK (M.S.) INDIA

in ongoing research concerning xenotransplantation prove it. This in future may at last end the long wait for people seriously needing organ transplants. This is the silver lining in dark clouds for end-stage organ failure patients. The

success of xenotransplantation is possible only if there is concerted social, scientific and ethical will.

