

DEVELOPMENT OF DE-CELLULARISED TISSUE FOR CARDIOVASCULAR APPLICATION

KLDB Board

SCTIMST

Decellularised Bovine tissue for congenital heart surgery



Pericardium



Jugular vein

Duration 3 years



Kerala Livestock Development Board

RELEVANCE IN INDIA

- **Estimated Congenital Heart Disease is about 8 in 1000 births**
- **10 to 15% needs valve conduit**

DECELLULARISED XENOGRAFTS

- **Readily available**
- **Less degeneration and calcification**
- **Long durability (no re-operations)**
- **Growth potential (important for growing children)**
- **Complying to safety requirement as per International standards**

PROPOSED PROJECT

- **Animal tissue to be sourced from 'low risk herd' from KLD Board & delivered to SCTIMST.**
- **Each animal is traceable.**
- **Genetic material has been introduced only from herds with the same BSE free status.**
- **Establishment of quality system at site of collection of animal tissue (bovine pericardium and bovine jugular vein from 6-8month old calf) under minimum bio-burden condition from Kerala Livestock Development Board Farms based on BS EN 12442:2000, part 2 & delivered within 24 hrs.**

RESPONSIBILITIES OF SCTIMST

- **Development of decellularised animal tissue.**
- **Biological, mechanical and microbiological characterization of decellularised tissue.**
- **Development of Quality system documents.**
- **Production of 50 devices each of**

**Decellularised bovine jugular vein
Decellularised bovine pericardium**

- **Pre-clinical safety and efficacy evaluation of above devices**

PROPOSED OUT PUT

- **De-cellularised Bovine pericardium (50 no.s)**

as a patch material in cardio-vascular surgical-corrections.

- **De-cellularised bovine jugular vein (50 no.s)**

as a valve conduit in congenital heart surgery-(RV to PA conduit).

JOINT KLDB-SCTIMST PROJECT

Development of decellularised animal tissue for cardiovascular applications

Treated animal tissues have been used in cardio-vascular surgery since the early 1970's. The standard technique used internationally today involves the use of fixatives like Glutaraldehyde to avoid immunogenicity. Heart valves made using the pig's valves or heart valves fabricated from bovine pericardium are being used widely in cardiac surgery for the last 3 decades. However, these tissues cannot be used in young patients, as they severely calcify within in 3 to 5 years of implantation. To circumvent this problem, techniques are being developed worldwide, which will avoid the use of Gluteraldehyde or which neutralizes the residual Gluteraldehyde. Another approach is to produce decellularised tissues, which are devoid of cells but with the extra cellular matrix that can act as a scaffold for cells to grow into, once it is implanted in patients. De-

cellularised animal tissue will be more durable as it will allow growth of tissue into it when implanted in patients. Moreover, due to the absence of cells, the tissue will not induce any immune rejection problems. Further, it is expected that the decellularised animal tissue may integrate into the patient tissue structurally as well as physiologically and may also grow along with the patient, which will be of utmost importance in pediatric patients.

In India approximately 10% of infant mortality is contributed by congenital heart disease alone. As a critical treatment, surgical correction of these disease conditions such as Tetralogy of Fallot, Pulmonary atresia, Transposition of great arteries with VSD and pulmonary stenosis requires patches or valved conduits. At present, a good and satisfactory substitute materials meeting the requirements of these growing children does not exist for application in these critical surgical procedures.

This project aims at producing de-cellularised animal tissue such as bovine pericardium and bovine jugular vein for pediatric cardiac surgery. The quality animal tissue used in this project is to be sourced from male

animals reared at Kerala Livestock Development board farms and slaughtered for meat purpose. At present animal tissue of biomedical quality is not produced anywhere in India.

Fabrication of medical device requires quality animal tissue, which is to be sourced from a 'low risk herd' or 'well monitored herd'. The Kerala Livestock Development Board is maintaining modern dairy farms complying with the quality system requirements of ISO 9001 and therefore has the unique distinction of having a 'low risk herd'. It is planned to upgrade the present facility at KLDB farm Kulathupuzha to produce animal tissue of biomedical quality complying to ISO standard 12442.

The team at Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum will decellularise animal tissue received from the KLDB using the process developed indigenously. These processed tissues will be evaluated by a battery of tests to ensure their safety and efficacy. At the end of the project, it is expected that the bovine pericardium as "patch material" and bovine jugular vein as "valved conduit" produced through this novel technique will meet the international safety requirements needed for such applications.