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Oran Transplantation: A Life Saving Technique

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Abstract: *Organ transplantation save a life of patients suffering from organ failure. it also helps patients to improve their overall life and the health of the patient . Organ transplants have significantly improved over the past 20 years and often produce excellent outcomes in children and young adults. It could be the milestone in our modern healthcare system. It brings the new hope for the patients who suffering from serious disfunctioning of organs or having some severe complications, before few decades there was no hope for those patients but now and in upcoming future we can save many lives with this technology. Thanks to our researchers who are working to give this hope to humanity.*

Keywords: Organ Transplant, Techniques of Organ Transplant, Future of Organ Transplant, Modern Technique's of Organ Transplant

I. INTRODUCTION

The creation of completely new organs for patients was prophesied by specialists thirty years ago, while the area of tissue engineering was only beginning to take shape. After all, millions of individuals who have knee or hip replacements can attest to the fact that replacement parts made of plastic or metal are now a reality.

Therefore, why aren't we producing replacement livers, kidneys, and lungs in 2022 to close the gap that donor organs are unable to fill?

The demand for transplantable organs now outweighs the supply by a wide margin, and the need might increase significantly over the next years. Considering how organ function could be replaced in the future is therefore appropriate. In this communication, we look at new technologies that may be utilized to replace organ function, challenges in implementing new technologies, and how these challenges might now be solved in the creation of new strategies for organ replacement.

Over the coming years, the necessity for organ replacement may drastically shift. The incidence of certain of the disorders that lead to organ failure and, consequently, the requirement for transplantation will decline as a result of new medical therapies, improved nutrition, and improved public health strategies. For instance, a healthier diet and therapy with 3-hydroxy-3-methylglutaryl coenzyme A (HMG-coA)-reductase inhibitors may, in some, or even many, people, avoid atherosclerosis and heart failure. But if people live longer due to advancements in medicine, diet, and public health, more people will be exposed to aging-related disorders including diabetes and heart and kidney disease. As a result, organ failure will become more common and transplantation may become more necessary.

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II. IMPORTANCE OF ORGAN TRANSPLANT

Organ transplantation save a life of patients suffering from organ failure .it also helps patients to improve their overall life and the health of the patient. Organ transplants have significantly improved over the past 20 years and often produce excellent outcomes in children and young adults. However, the percentage of older transplant patients with comorbidities is increasing, posing a greater difficulty. In contrast to dialysis, renal transplantation enhances patient longevity, and irreversible disorders of the liver, heart, or lungs must be treated with life-saving transplants. While the activity of solid organ transplant programs has been continuously increasing, there are still many unmet needs throughout the world and significant regional variations. Solid organ transplantation is necessary for advanced and established healthcare systems.

III. HISTORY OF ORGAN TRANSPLANT

The Ebers Papyrus,(1550 BC) mentioned skin grafting for the treatment of burns, is credited as being the earliest documented record of transplant.

The earliest procedures in plastic surgery, including full-thickness skin grafts, are attributed to the Indian surgeon Sushruta he is known as the father of surgery and is believed to have carried them out around 600 BC.(2)

After that the successful organ transplant which performed in 1954 , it was a kidney transplant surgery. The risk of organ rejection kept the number of transplants down until the early 1980s. The demand for transplants increased as a result of medical developments in the prevention and treatment of rejection.

The organ donation and recovery system in the United States is now one of the best in the world. Innovation and ongoing development have given the gift of life to more transplant recipients than ever before. (1)

3.1 Modern Technologies and Steps in Organ Transplant

A. The availability of Modern Induction Treatment with Immune Suppressants

A milestone in transplant surgery was the development of immunosuppressant medication, which stifled the immune system to prevent organ rejection. The first medication that made it possible to effectively transplant organs from unrelated donors was azathioprine when it was combined with prednisolone. Following this, better medications including ciclosporin, tacrolimus, sirolimus, everolimus, and mycophenolic acid were developed, improving the chances of survival for transplant patients. In order to reduce the dose of immunosuppressant’s without running the risk of organ rejection, biological agents like monoclonal or polyclonal antibodies are currently utilized in conjunction with immunosuppressant’s.

B. Effective Organ Preservation Techniques

Reduced tissue damage and excellent organ preservation in vivo till transplant have been made possible by maintaining organs at or below 4°C and using specialized preservative solutions for various organs. Additionally, a number of cutting-edge surgical techniques are performed during organ extraction to preserve donor organs as little as possible. (3)

C. The Creation of in Vitro Organs

There is a severe lack of donated organs throughout the world, and many people pass away while awaiting a transplant. To close this supply-demand imbalance, scientists are now considering the possibility of creating organoids and tissues from stem cells. Before these organs can be utilized for transplants, however, a number of technical issues must be resolved, including the requirement to integrate circulatory pathways and create substantial structures like the ureter.

D. Xeno Transplantation.

With the use of genome editing tools, scientists are also looking into the possibility of creating human organs in huge animals. Pigs are most likely the species being studied for their potential to serve as organ donors since their organs are similar in size to those of humans. Additionally, they have a quick gestation time and give birth to a large number of easily farmable offspring that can be genetically altered. However, there are a number of obstacles in the way, such as ethical, physiological, and immunological ones.

E. Preservation of Deceased Organs

Currently, for transplants to be effective, they must be performed within a few hours. Numerous organs are squandered because transplant candidates cannot be found nearby or because of logistical problems. More recent research is being done to preserve donated organs for future use in order to save the lives of many more people.

F. Treatment Before Transplant.

Immunosuppressant's must be used for the rest of a patient's life in order to prevent organ rejection. These medications not only cost a lot of money, but they also put patients at risk for infections. Technological and scientific advancements may make it possible to prepare a transplant recipient before the procedure, which would eliminate the need for immunotherapy.

G. Organ Preparation

Preconditioning of donated organs is another field that is still developing. The goal of this is to increase the number of donors by securing high-quality organs from unreliable sources. To increase the treatment choices available to patients receiving post-operative care following transplant surgery, research is also being done in the fields of tissue repair, high-precision tumour targeting, immune modulation, and genetic engineering.(2,3.)

IV. FUTURE DIRECTION

4.1 Tissue Engineering and Regenerative Medicine

Lets discuss about what is tissue engineering and regenerative medicine .

Tissue engineering advanced from the sphere of biomaterials improvement and refers back to the exercise of mixing scaffolds, cells, and biologically lively molecules into purposeful tissues. The purpose of tissue engineering is to bring together purposeful constructs that restore, maintain, or enhance broken tissues or complete organs. Artificial pores and skin and cartilage are examples of engineered tissues which have been permitted with the aid of using the FDA; however, presently they have got restricted use in human patients.

Regenerative medicine is a broad field that includes not only tissue engineering but also self-healing research. In self-healing research, the framework uses its own system to remodel cells and rebuild tissues and organs. Sometimes we use living tissue from overseas. The terms "tissue engineering" and "regenerative medicine" have become almost interchangeable as the world wants to see cures and not cures for complex and recurring chronic diseases. This topic is constantly evolving. In addition to clinical packages, non-curative packages can be used to detect organic or chemical hazards using tissues as biosensors and to confirm toxicity of experimental drugs using tissue chips.(4)

So lets discuss about How can regenerative medicine and tissue engineering integrate into existing medical procedures.

Although the impact of tissue engineering in patient care is still limited, it is now used. Implants for extra bladders, micro arteries, skin grafts, cartilage, and even a whole trachea have been given to patients, but the procedures are still in the experimental stage and are very expensive. Even while more complex organ tissues, like heart, lung, and liver tissue, have been successfully recreated in the lab, they are still not entirely reproducible and ready for implantation into a patient. But there is a lot of research potential with these tissues, especially in the field of drug development. It may be possible to speed up development, provide essential tools for facilitating individualized care, reduce costs, and eliminate the need for animal testing by using active human tissue to screen drug candidates.(4)

There are some examples in this research field are as follows,

4.2 Controlling Stem Cells through their Environment

In an effort to discover novel medicines, scientists have long looked for strategies to regulate the differentiation of stem cells into different cell types. Pluripotent stem cells, which are able to differentiate into any form of cell, have been cultivated by two NIBIB researchers in various sorts of confined areas. They discovered that this confinement activated highly particular gene networks that controlled the cells' eventual fate. The majority of other medical research on pluripotent stem cells has been on altering the combination of growth solutions that the cells are put in. As researchers work to harness stem cells for medicinal applications, they have discovered that the process by which stem cells differentiate into different cell types is governed by biomechanics.(4,)

4.3 Implanting a Human Liver in Mice

Researchers supported by the NIBIB (*National Institute of Biomedical Imaging and Bioengineering* (*NIBIB*) have created human liver tissue that can be inserted into a mouse. The mouse still has its own liver and can continue to operate normally, but with the addition of the modified human liver, it can also metabolize medications in a manner similar to that of humans. In addition to demonstrating species-specific responses that ordinarily do not surface until clinical trials, this enables researchers to examine susceptibility to toxicity. This method of generating novel medications using altered human tissue might speed up the process, reduce costs, and enable in-depth analyses of drug-drug interactions in a human-like system. (4,)

4.4 Tissue Engineering by using Mature Bone Stem Cells.

The first published study that was able to carry stem cells all the way from their pluripotent condition to mature bone grafts that may perhaps be implanted into a patient was accomplished by researchers with NIBIB funding. Until recently, researchers could only differentiate the cells into an early stage of tissue that was only partially functional. The study also discovered that there were no aberrant growths after implanting the bone in immunodeficient mice, an issue that sometimes arises after implanting stem cells or bone scaffolds (A structure of artificial or natural materials on which tissue is grown to mimic a biological process outside the body or to replace a disease or damaged tissue inside the body.) Alone. (4,7,8)

4.5 Regenerate a new Kidney from a Patient's Own Cells.

For the thousands of individuals with renal illness, it would be a huge relief. Researchers financed by NIDDK made ground-breaking discoveries in this area by first removing cells from a donor organ and then using the collagen scaffold that was left to direct the formation of new tissue in experiments on rat, pig, and human kidney cells. Epithelial and endothelial cells were grafted onto kidney scaffolds in order to produce functional kidney tissue. The resultant organ tissue could make urine both in vivo and in vitro in rats, as well as be able to reabsorb nutrients and remove metabolites. (4,7,8)

4.6 3D Bio Printing Technology in Organ Transplant

Regenerative medicine offers hope for bridging the gap between the lack of organs and the need for transplants by designing viable tissues or organs to repair or replace defective and necrotic tissues and organs. Due to its great integration potential for patient-specific designs, accurate and quick production capabilities with high resolution, and unrivalled adaptability, three-dimensional (3D) bioprinting is developing into an unmatched bio-manufacturing technique. It offers fine control over various compositions, geographic distributions, and architectural accuracy/complexity, providing successful recapitulation of the microstructure, architecture, mechanical characteristics, and biological activities of the target tissues and organs. An overview of current developments in 3D bioprinting technology is given here, along with design ideas for bioinks that are appropriate for the procedure. With a particular emphasis on the heart, the liver, neural networks, and vasculature, we concentrate on how this technology may be used to create living organs. We wrap off with a discussion of the present issues and the technological outlook for 3D organ bioprinting going forward.(5,6)

V. CONCLUSION

The organ transplantation is a new hope for the patients and the technique can change the whole definition of organs. The lab grown organ is already on experimental stages and soon we can meet with the perfection. the technology of organ transplant is changing rapidly and getting more perfect and advanced it is saving many lives and adding a smile on patients life .

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