

### Pancreas Transplant in India: Progress and Future

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#### Introduction

Diabetes is a major public health problem in both developed as well as developing countries. The global prevalence of diabetes is estimated to be around 11% amongst the age group of 20-79 years. Diabetes is one of the leading causes of chronic kidney disease (CKD) and end-stage kidney disease (ESKD) accounting for 50% of cases globally.<sup>[1]</sup> Pancreas transplant offers the definitive cure for this disease. The first successful pancreas transplant was carried out by WD Kelly in 1966, refinements in surgical techniques and advancements in immunosuppressive therapy over last three decades have greatly improved the results and prognosis of pancreas transplant.<sup>[2]</sup>

Pancreas transplant is the only treatment that helps to maintain euglycemia and prevents metabolic disturbances which frequently occur in type 1 diabetes patients that persists and even worsen in patients when only kidney transplantation is done. As more and more centres are offering simultaneous pancreas and kidney transplant, 1 year and 5 year survival rates are comparable to other solid organs transplantation.<sup>[3]</sup>

Indications for pancreas transplant are<sup>[4]</sup>

- Severe complications of diabetes mellitus with frequent and severe hypoglycemia or ketoacidosis.
- Poor quality of life in spite of insulin therapy.
- Patients with type 1 diabetes with end-stage renal failure on dialysis.

Various methods of pancreas transplantation are<sup>[4]</sup>

1. Pancreas transplant alone (PTA)
2. Simultaneous pancreas and kidney transplant (SPK)
3. Pancreas after kidney transplant (PAK)
4. Simultaneous deceased donor pancreas and live donor kidney transplant

Table 1. Eligibility criteria for pancreatic transplant<sup>[4]</sup>

Transplant type	Eligibility
Pancreas transplant alone	<ul style="list-style-type: none"> <li>● Insulin-treated type 2 diabetes mellitus with body mass index <math>\leq 30\text{kg/m}^2</math> or</li> <li>● Type 1 diabetes mellitus with at least two severe hypoglycaemic states within last 24 months and be specially assessed as having disabling hypoglycaemia</li> </ul>
Simultaneous kidney pancreas transplant	<ul style="list-style-type: none"> <li>● Pancreas transplant alone requirements and</li> <li>● Receiving dialysis or glomerular filtration rate <math>&lt; 20\text{mL/min}</math></li> </ul>

SPK is now the first choice of treatment in a patient with type 1 diabetes mellitus and related end-stage renal disease. Pancreas alone transplant can be done in patients with preserved kidney function and hypoglycaemic unawareness.<sup>[5]</sup>

#### Islet Cell Transplant

The incidence of islet cell transplantation have reduced after discovery of insulin. There was a realization that apart from the inconvenience of repeated glucose measurements and insulin injections, many patients still had to face the major complications of diabetes. The regimen followed for islet cell transplantation is "Edmonton Protocol" which consists of transplanting an adequate islet mass sometimes from sequential donors ( $> 10,000$  islet equivalents per kg recipient body weight), immediate infusion of the islets following isolation, and avoidance of corticosteroids. As in whole pancreas transplantation, the islets can be transplanted alone or after kidney transplantation.<sup>[6]</sup>

#### Pancreas Transplant in India

About 1000 pancreas transplants are performed in the USA each year. In contrast to this, less than 100 such transplants have been performed so far in India. At present, only a few centres across the country offer pancreas transplant on a regular basis including Mahatma Gandhi Medical College & Hospital, Jaipur.<sup>[7]</sup>

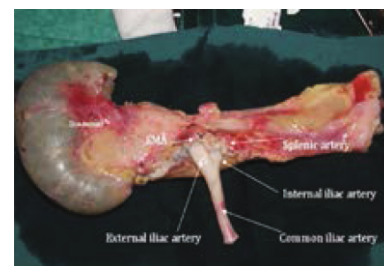


Figure 1 (a) Explanted pancreas specimen after reconstruction

The reasons for lack of pancreas transplantation in our country has been the lack of availability of deceased organ donors. This situation is changing fast with over 900 deceased organ donation in 2022.<sup>[7]</sup>



Figure 1 (b) Implanted pancreas

#### Challenges in Indian Settings at Present

Although there is an increase in number of deceased organ donors in India, the number of pancreas transplants are still low. This is because unlike kidney and liver, only a small proportion of all donated pancreas' can be used for transplantation, as criteria for pancreas suitability for transplantation are very stringent like age limit between 10-45 years, obesity etc.<sup>[7]</sup>

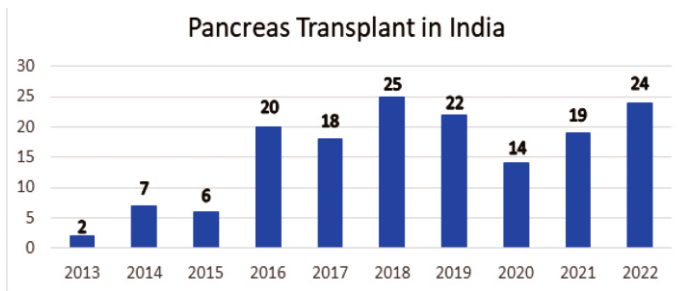


Figure 2 depicting total number of pancreas transplants in INDIA from 2013-2022.<sup>[8]</sup>

### Future in pancreas Transplant

Segmental pancreas transplant from live donors has also been reported. The success of this concept potentially bypasses the issues surrounding organ shortage for waitlisted patients in the same way as in live kidney/liver transplant. With technological advancement, the new devices to improve blood glucose monitoring and insulin therapy are being developed to reduce the risk of wide fluctuations in blood sugars. An artificial pancreas also known as closed-loop insulin delivery systems use a continuous glucose monitoring that measures interstitial glucose concentration, an insulin pump, and a control algorithm to calculate insulin dose and maintain normoglycaemia without user input.<sup>[9]</sup>

### Other Recent Advances in Pancreas Transplant

Advances over the last decade suggest that generating functional beta-cells from stem cells is achievable. However, there are aspects of beta-cell development including the signalling pathways that instruct endocrine progenitor cells to differentiate into mature and functional beta-cells which remain poorly understood. These ideas combined with ideas of biological printing using the extracellular matrix as a scaffold to recreate a new biological pancreas are exciting, and although have their own challenges may change the way transplant is performed.<sup>[10]</sup>

### Conclusion

Pancreas transplant in association with simultaneous kidney transplant is growing and has quickly become the gold standard of care for patients with type 1 diabetes mellitus and renal failure. Significant improvements in quality of life and increase in life expectancy make pancreas transplant an economically viable option. It remains the most effective method of establishing and maintaining euglycemia, halting and potentially reversing complications associated with diabetes mellitus.

### References

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### Pancreas transplants from different regions of the world

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
United States of America	1082	1043	1018	954	947	1013	1002	1027	1015	962	963	-
United Kingdom	236	254	264	239	244	206	202	217	185	116	137	146
Brazil	184	151	163	140	121	134	111	150	177	148	162	133
Germany	171	161	128	120	105	97	72	95	94	92	65	44
Spain	111	83	92	81	97	73	70	82	76	73	82	92
Canada	108	72	77	77	76	95	76	57	69	57	53	-
Argentina	75	68	76	69	74	48	62	89	74	48	39	36
France	73	72	85	79	78	90	96	78	84	34	67	70
Italy	58	67	59	43	50	67	39	41	42	41	54	38
Australia	26	38	33	45	45	51	49	51	40	47	37	-
India	-	-	2	7	6	20	18	25	22	14	19	24

Source: <https://www.transplant-observatory.org/> (As on June 30, 2023)

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