Measurement of serum c-peptide in patients following simultaneous pancreas and kidney (SPK) transplants

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Introduction

Who gets an SPK transplant? Traditionally, patients with type I diabetes, <50 years of age who are approaching end stage renal disease or are already on dialysis, are regarded as suitable candidates for SPK transplantation. C-peptide is eliminated from the blood by glomerular filtration. 15 years after the diagnosis of type I diabetes very few patients exceed c-peptide concentrations of 200 pmol/l, even after stimulation with a mixed carbohydrate meal and probably even in renal failure (Bhargava *et al*). Patients therefore typically have low serum c-peptide prior to transplantation and c-peptide concentrations can be used post transplantation to monitor both pancreatic and renal graft function.

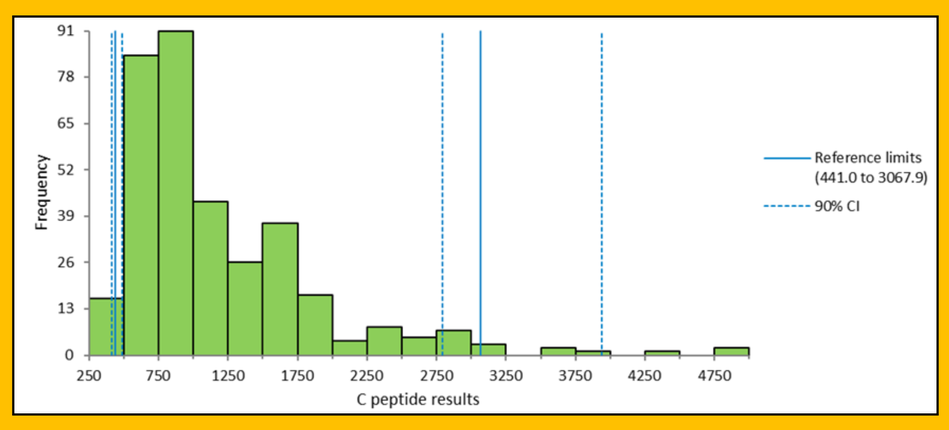
Figure 1 – Reference Interval

A reference interval was determined from the 2.5th to 97.5th percentiles for the data (n=347).

	N					
	347					
	Mean	SD	Skewness	Kurtosis		
C peptide results	1181.9	703.6	2.1	5.99		
	Minimum	1st quartile	Median	3rd quartile	Maximum	IQR
C peptide results	275	725.0	940.0	1507.3	4866	782.3

Reference Limits

	Limit	90% CI
2.50%	441.0	410.0 to 490.0
97.50%	3067.9	2790.0 to 3939.0

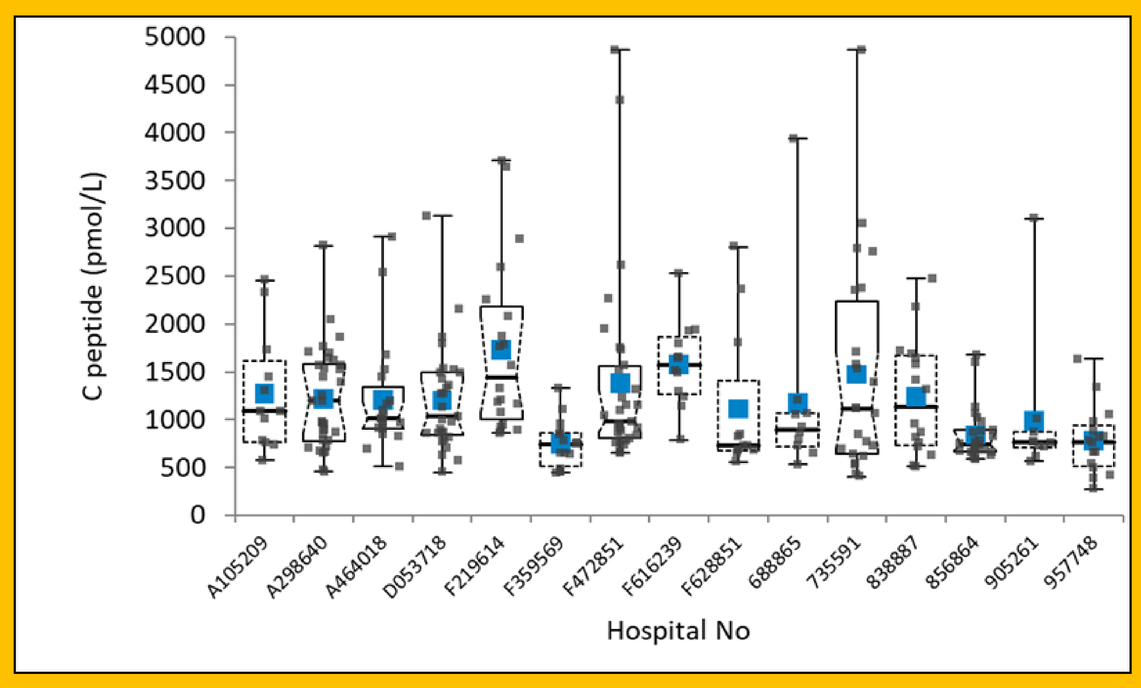


What did this study aim to achieve?

This study aimed to review serum c-peptide concentrations in successful SPK transplant patients to look at the biological variation in c-peptide concentrations and to determine whether the reference interval for c-peptide concentrations in SPK patients was different to the laboratory reference interval for c-peptide.

Figure 2 Biological variation

Data for individual SPK patients with 10 or more c-peptide results, illustrating the variability in c-peptide concentrations



Discussion

- The higher upper limit of the reference interval suggests that SPK transplant patients may have a degree of insulin resistance.
- The pancreas is systemically drained, so release is directly into the inferior vena cava and there is no first pass metabolism / regulation via the liver which could impact on why c-peptide results can be so variable, even in same patient.
- The creatinine and HbA1c criteria used to select patients for this study were chosen in order to identify patients with successful grafts from the laboratory system. From a patient perspective, transplant failure would not be defined as a creatinine of over 200 umol/L or HbA1C greater than 48 mmol/mol as these concentrations could actually be "normal" for some recipients. Failure would be more accurately defined as a return to dialysis and requiring some sort of additional beta cell replacement treatment (incretin if early impairment, insulin if sugars deranged).

Patients

37 SPK transplant patients were identified from the laboratory database (18 female and 19 male). Patients with failed transplants as defined by a serum creatinine over 200 umol/L or a HbA1c ≥48 mmol/mol or clinical details of failed transplant/pancreatectomy were excluded (6 females and 5 males). This generated a data set of 347 c-peptide results obtained from 26 individual patients.

Conclusion

The laboratory quoted reference interval for c-peptide for a healthy fasting individual with a normal blood glucose, is 350-1800 pmol/L. For patients monitored following SPK transplant, it may be appropriate to use a reference interval of 441 – 3068 pmol/L. Intra-individual biological variation in c-peptide concentrations is variable from patient to patient.

Acknowledgements
Thanks to Dr Angie Cooper for collating some of the data used in this study and also to Dr Imran Saif, Consultant Nephrologist in Derriford Hospital and Mr James A Gilbert, Consultant Transplant & Vascular Access Surgeon at Oxford University Hospitals NHS Foundation Trust for their helpful discussions.

Reference

Ramya Bhargava, Nicos Mitsides, Imran Saif, Patrick MacDowall and Alexander Woywodt, C-peptide and combined kidney-pancreas transplantation, Nephrology Dialysis Transplantation Plus (2009) 2: 489–492, doi: 10.1093/ndtplus/sfp132 (accessed December 2020)