

Virtual liver transplant assessment: a novel pathway that is likely safe, effective and optimises access to transplantation

Liver transplantation (LT) is a life-saving treatment for patients with

end-stage chronic liver disease. Given the negative impact of distance from transplant centre on patient outcomes,^{1,2} King's College Hospital (KCH) developed a network of satellite liver transplant centres (SLTCs) in Plymouth and Belfast to optimise access to LT.³ These centres deliver transplant assessment and comparable post-LT care to conventional LT centres.⁴ However, patients are still required to complete their assessments at KCH prior to listing.

The COVID-19 pandemic has caused unprecedented strain on health services globally. The UK LT programme was affected with transplantation and assessment occurring only in patients with urgent need.⁵ However, patients at SLTCs were also subject to travel restrictions which further disadvantaged them compared with local patients. A virtual transplant assessment (VTA) pathway was developed to allow SLTCs to assess their patients for LT locally and to discuss listing without attendance at KCH. Here, we describe our first experiences with this novel pathway.

We retrospectively included all patients from both SLTCs who completed an LT assessment between April 2020 and April 2021. The decision for a VTA was made by consensus decision from the multidisciplinary teams at the relevant SLTC and KCH (online supplemental figure 1). While there were no strict criteria defining selection of assessment pathways, if there were significant concerns regarding a patient's transplant candidacy they underwent a face-to-face assessment (FTFA).

Patients' clinical notes were interrogated for demographic data, clinical data and laboratory data from time of assessment. Outcomes including time from listing to transplantation and short-term post-LT outcomes were also evaluated. Patients undergoing FTFA were directly compared with those undergoing VTA. A *p* value of <0.05 was considered statistically significant

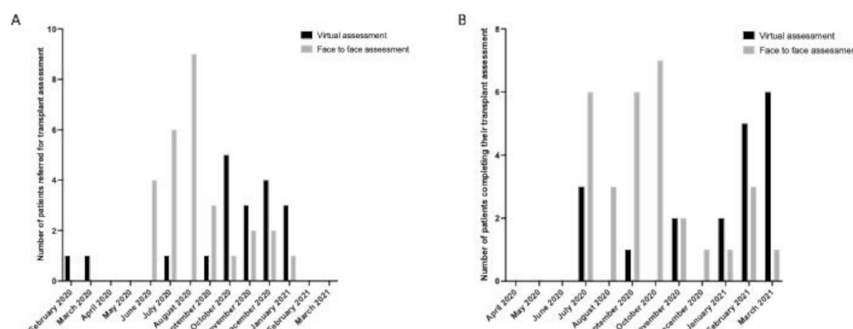


Figure 1 Time of referral and completion of LT assessments in patients from SLTC. (A) Number of patients referred per month for patients completing LT assessments from SLTCs between April 2020 and April 2021. (B) Number of patients completing assessments per month from SLTCs between April 2020 and April 2021. LT, Liver transplantation; SLTC, satellite liver transplant centre.

(*). All analyses were performed using Prism V.9.1.2 (GraphPad, San Diego, California, USA).

Forty-nine patients from SLTCs underwent transplant assessment during this period (19 VTAs and 30 FTFAs). **Figure 1A** demonstrates when patients were referred for LT assessment and **figure 1B** demonstrates when patients had completed their LT assessment. Of note, the VTA pathway was used for two patients referred prior to the pandemic. It also shows the VTA pathway being increasingly used after September 2020 (**figure 1A**), and this overtook the FTFA pathway in 2021 as the primary assessment pathway for patients referred from SLTCs. Patients assessed via VTA had an increased time from referral to completion of their assessment (*p*=0.01*) (online supplemental table 1). However, patients referred in 2021 to the VTA pathway had a shorter time to completion of their assessment than those referred in 2020 (*n*=3, median 38 days (IQR 25–55), versus *n*=16, median 83 days (IQR 48–130.3)). This likely reflects that the pathway was used to clear the initial backlog of referrals as well as the initial challenges in establishing a new pathway. The VTA pathway remained functional through the second wave of COVID-19, whereas the FTFA pathway did not.


Online supplemental table 1 demonstrates the characteristics of each patient cohort. While there

was a trend for patients in the VTA cohort to be younger, no significant differences were demonstrated between the two cohorts for demographic or clinical variables, prognostic scores or likelihood of listing for LT. However, we must acknowledge that our results are preliminary, and differences between cohorts may become apparent as we assess more patients. We anticipate that FTFA will be reserved for patients with more complex liver disease and comorbidities.

Of the patients listed for transplant, no patients were delisted following listing in the VTA cohort. Three patients were delisted in the FTFA cohort. Six patients from the VTA cohort and 11 patients from the FTFA pathway were transplanted during the study. Survival analysis demonstrated no difference in time from listing to transplantation between each cohort (*p*=0.25). No patients in the VTA pathway had a surgical complication; median intensive care and KCH inpatient lengths of stay were 1.5 and 11.0 days respectively. These data are reassuring for the safety of the VTA pathway, although longer-term follow-up data are required to evaluate this pathway. Furthermore, patient and healthcare professional satisfaction needs to be evaluated.

We describe the first UK experience of a VTA pathway in LT. While our experience is preliminary, we demonstrate that this pathway is feasible and may increase access

to transplantation for patients and address a well-documented health-care inequity.^{1 2}

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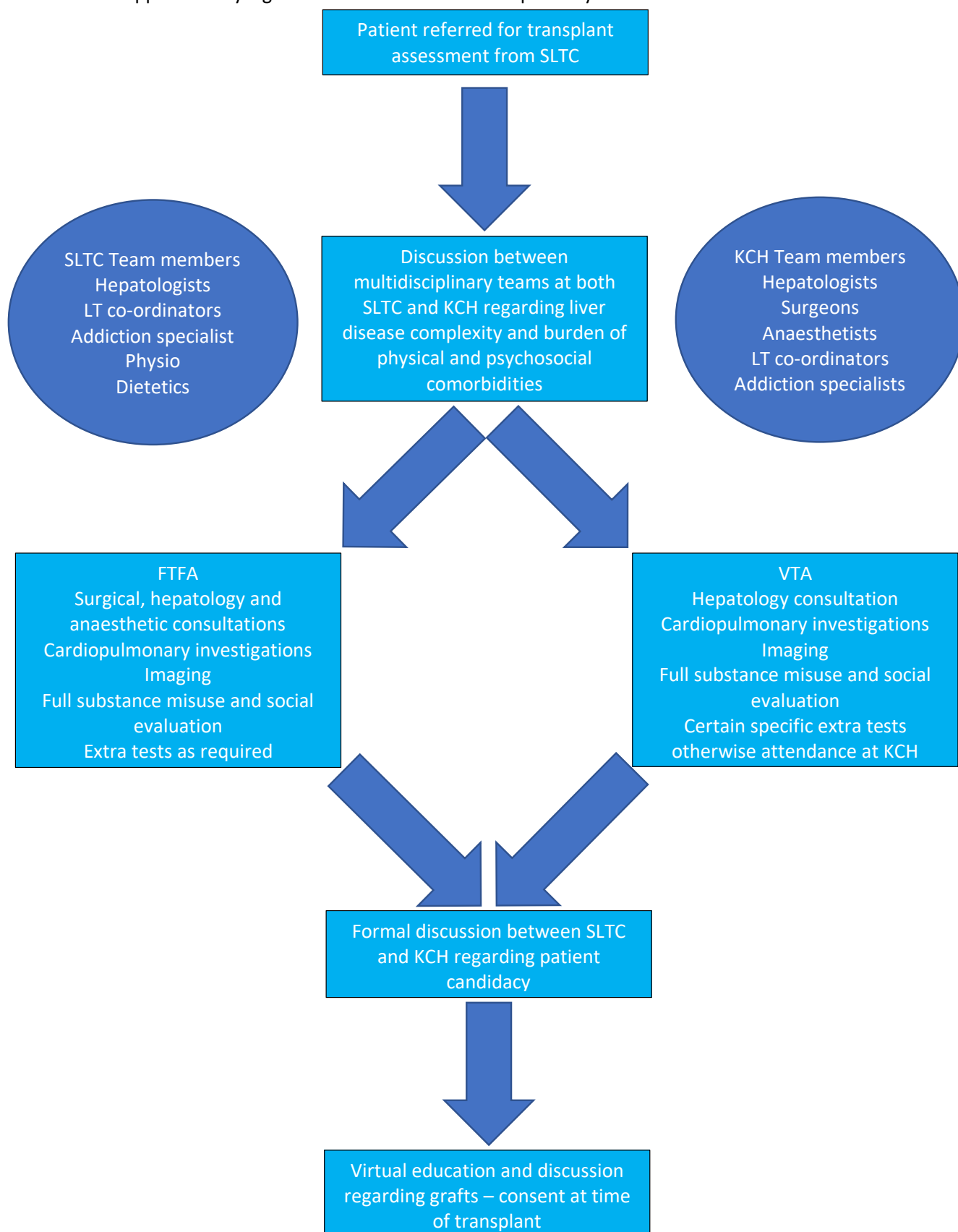
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Supplementary Figure 1 – Overview of the SLTC pathway



Variable	N	VTA (n=19)	N	FTFA (n=30)	P value
Age	19	57.0 (49.0-60.0)	30	61.5 (56.8-64.3)	0.05
Sex (male)	19	13 (68.4%)	30	18 (60.0%)	0.76
Current/Ex-smoker	19	8 (42.1%)	29	14 (48.3%)	0.77
ARLD	19	9 (47.4%)	30	9 (30.0%)	0.24
NAFLD	19	2 (10.5%)	30	5 (16.7%)	0.69
Autoimmune liver diseases (PBC/PSC/AIH)	19	6 (31.6%)	30	13 (43.3%)	0.55
Redo transplantation	19	1 (5.3%)	30	0 (0.0%)	0.39
HCC	19	0 (0.0%)	30	2 (6.7%)	0.52
UKELD	19	54.5 (5.7)	30	54.1 (6.0)	0.81
MELD	19	12 (10.3-16.8)	30	10 (6.8-13.5)	0.10
CP score	19	8.6 (2.7)	30	7.8 (1.6)	0.24
Time from referral to completion of assessment	19	62 (48.0-125.0)	28	42 (21.0-54.5)	0.01*
Patient listed for transplant	19	18 (94.7%)	30	26 (86.7%)	0.64

Supplementary Table 1. Table demonstrating a comparison of demographic, clinical and prognostic scores between patients assessed via VTA and FTFA.

Results from *t* tests are displayed as mean (SD). Results from Mann Whitney *U* tests are displayed as median (IQR). Results from Fisher's exact tests are presented as

number (%). Statistical significance was determined by a p value <0.05 and signified by *.