SAFETY OF INTRA-OPERATIVE BLOOD SALVAGE IN HEPATOCELLULAR CARCINOMA LIVER TRANSPLANTATION: TUMOUR CELL DETECTION VIA SPIRAL MICROFLUIDICS TECHNOLOGY

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INTRODUCTION

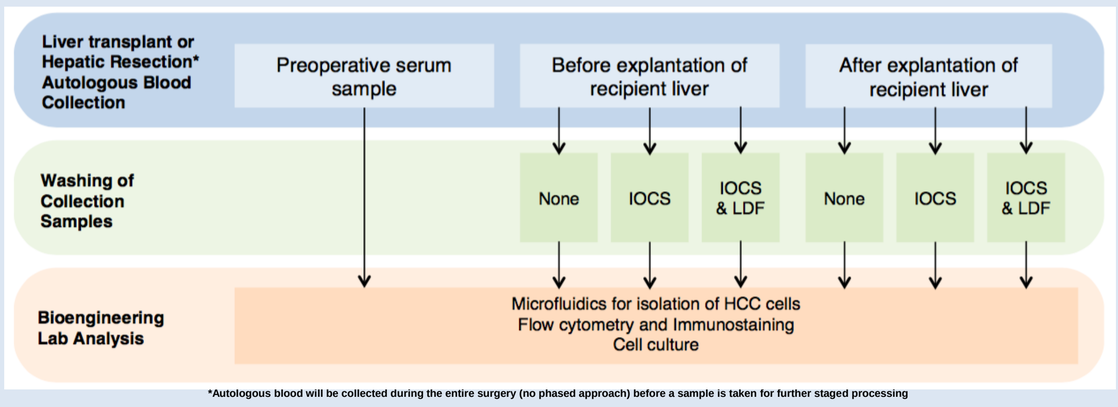
- Liver transplantation (LT) is a recognized surgical treatment option for hepatocellular carcinoma (HCC).
- It is associated with high transfusion requirements due to significant intra-operative blood loss.
- Intra-operative blood salvage autotransfusion (IBSA) provides the following benefits:
  - Reduced requirement for allogeneic transfusion and its associated risks, such as transmission of infectious diseases and blood transfusion reactions.
  - Improved cost-effectiveness
  - Viable alternative to allogeneic transfusions for Jehovah's Witnesses undergoing surgery.
- However, its use remains controversial in oncological cases due to the theoretical risk of tumor cell (TC) reintroduction.
- Current studies analyzing blood samples for TC remain limited due to suboptimal detection techniques.[1]

OBJECTIVES

- Evaluate presence of HCC TC in autologous blood samples recovered intra-operatively using highly sensitive microfluidics.[2]
- Evaluate the utility of the cellsaver machine (IOCS) and leucocyte depletion filters (LDF) in reducing tumor load and viability in the retrieved autologous blood.
- Pave the way for IBSA use in future HCC LT cases, minimizing the need for allogenous blood transfusion and its attendant adverse effects.

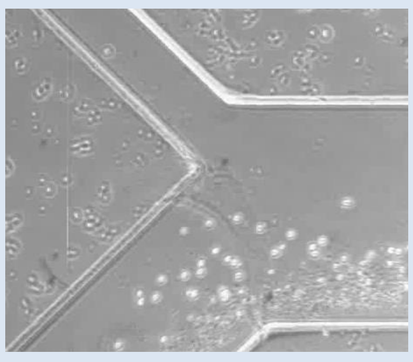
METHODOLOGY

- Prospective study of all adult HCC patients who underwent LT in National University Hospital Singapore between the periods of November 2017 to July 2018

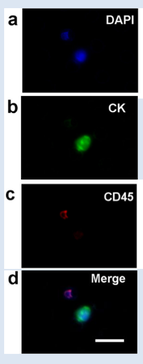


*Autologous blood will be collected during the entire surgery (no phased approach) before a sample is taken for further staged processing

ClearCell Chip



Spiral Microfluidics



TC Stains
CK – cells of epithelial origin
DAPI – stains for cell nucleus
CD45 – stains for WBC

RESULTS

- A total of 10 patients were recruited.
- All had tumor characteristics within the University of California, San Francisco (UCSF) criteria.

Table 1: Patient and Tumour Characteristics

Patient & Tumour Characteristics	HCC LT (n=10)
Median pre-operative AFP (range), µg/dL	17 (1.6 – 193.0)
Total tumour diameter (range), mm	51 (22 – 105)
Moderate grade of differentiation (%), n	6 (60.0)
Presence of vascular invasion (%), n	1 (10.5)
Presence of tumour rupture (%), n	0 (0.0)
Presence of perineural invasion (%), n	0 (0.0)
Median estimated blood loss (range), ml	2000 (600 – 4000)

Table 2: Presence of TC Pre & Post IOCS/LDF Filtration

Tube No.	1	2	3	4	5*	6*	7*
Patient 1	+	+	-	-	-	-	-
Patient 2	+	+	-	-	-	-	-
Patient 3	+	+	+	-	-	-	-
Patient 4	+	+	-	-	-	-	-
Patient 5	+	+	-	-	-	-	-
Patient 6	+	+	+	-	-	-	-
Patient 7	+	+	-	-	-	-	-
Patient 8	+	+	+	-	-	-	-
Patient 9	+	+	-	-	-	-	-
Patient 10	+	+	-	-	-	-	-

*1: Pre-Op Central Venous Sample, 2: From operative field, 3: Post-IOCS Washing, 4: Post-IOCS + LDF Filtration, 5: From operative field, 6: Post-IOCS Washing, 7: Post-IOCS + LDF Filtration; *Samples taken during neohepatic phase*

- All patients had presence of TC in their pre-op venous samples and samples from the operative field.
- While 3 patient samples were found with TC after IOCS washing, all samples were negative for TC after LDF filtration.

CONCLUSION

- Presence of TC within autologous blood samples from patients undergoing LT
- Combination of IOCS and LDF use is effective in removing tumor cell load
- Application of IBSA in HCC LT appears safe with minimal risk of TC reintroduction after filtration and should be considered

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ILTS 2019 P-392

Basic Science / Translational Research

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DOI: 10.3252/pso.eu.ILTS2019.2019

Poster presented at: ILTS Annual Congress 2019 Toronto, Canada

PosterSessionOnline.com