BAOMS Research Grant – FINAL REPORT - August 2022

Mr Karl F. B. Payne

Date awarded - March 2018. Grant received – October 2018 - £9,813

One year extension until October 2020, with further extension due to COIVD-19 pandemic. Grant spent in full and account closed in 2021

Original project title:

Circulating tumour DNA as a liquid biopsy and biomarker in head and neck squamous cell carcinoma (HNSCC)

Supervisors: Professor Hisham Mehanna, Mr Paul Nankivell and Dr Graham Taylor

Institution – University of Birmingham

Original research question

Can ctDNA be used as a liquid biopsy in HNSCC to assess tumour heterogeneity and a biomarker to detect tumour recurrence?

Secondary research question

Can circulating tumour cells be successfully isolated and characterised to assess intra-tumoural proteogenomic heterogeneity in HNSCC

Intiial efforts to answer the original research question using ctDNA were slow - due to technical issues with ctDNA extraction and poor data from subsequent genomic sequencing. Success was achieved with methylation array sequencing in a small patient cohort. Therefore, a decision was made to focus on an alternative liquid biopsy compartment – circulating tumour cells (CTCs), and to use funds from the research grant to optimise a novel microfluidic method of CTC enrichment and characterisation in HNSCC (the Parsortix platform).

Results

- Initial positive results to perform methylomic analysis of ctDNA in a HNSCC test cohort
- Successfully optimised Parsortix microfluidic device to enrich CTCs from HNSCC patients

- Combined microfluidic enrichment with flow and mass cytometry to perform multi-plex proteomic characterisation of CTCs in HNSCC
- Several presentations and high impact publications generated (see below) – all of which cite BAOMS as a source of funding

Further funding ahcieved as a result of BAOMS research grant

The BAOMS research grant was instrumental as a pump-priming grant to enable me to generate intial pilot data and be successful in achieving a fully funded Cancer Research UK Doctoral Fellowship. In addition, further smaller grants have been successful from BAHNO and the QE Hospital Birmingham Charity.

Presentation/publication of research output

- Oral presentation at the BAOMS 2019 scientific meeting – ***"High-throughput methylation profiling of cell-free plasma DNA in head and neck cancer: a pilot study"***
- Poster presentation at BAOMS 2020 scientific meeting – ***"Microfluidic based circulating tumour cell isolation using the Parsortix platform in head and neck squamous cell carcinoma"***

Publications

- Whalley C, **Payne K**, Domingo D Blake A, Richman S, Brooks J, Batis N, Spruce R, Mehanna H, Nankivell P, Beggs A. **Ultra-Low DNA input into whole genome methylation assays and detection of oncogenic methylation and copy number variants in circualting tumour DNA**. *Epigenomes* 2021; 5(1):6
- *(Article was initially submitted to BJOMS, but following unfavourbale review was published elsewhere)* **Payne K**, Brooks JM, Taylor GS, Batis N, Noyvert B, Pan Y, Nankivell P, Mehanna H. **Immediate Sample Fixation Increases Circulating Tumour Cell (CTC) Capture and Preserves Phenotype in Head and Neck Squamous Cell Carcinoma: Towards a Standardised Approach to Microfluidic CTC Biomarker Discovery**. *Cancers* 2021;13(21):5519
- *(Article was initially submitted to BJOMS, but following unfavourbale review was published elsewhere)* **Payne K**, J Brooks, N Batis, G Taylor, P Nankivell, H Mehanna. **Characterising the epithelial-mesenchymal transition status of circulating tumour cells in head and neck squamous cell carcinoma.** Head & Neck. 2022, August 1-10

Future work

I would like to say a sincere thankyou to BAOMS and the endowments committee for funding my early research. Following the success ahcieved in my PhD, the results are being expanded upon in a larger prospective cohort to combine ctDNA and CTC biomarkers as a predictive model in recurrent/metastatic HNSCC patients undergoing immunotherapy, as part of my NIHR ACL project.