Wales Data Nation Accelerator

Artificial intelligence-guided diagnosis and prognosis of post-operative sepsis

Summary

Early detection of post-operative infections present an urgent and unmet clinical need. Between 1 and 20% of colorectal cancer resections result in inflammatory complications and leaking bowel contents ('anastomotic leaks'), leading to worsening patient outcomes, including sepsis and reduced cancer survival.

Current tests are too late and not specific enough, at a time when most patients already show overt signs of infection such as fever and pain at the surgical site. Early biomarker signatures in the drain fluid are likely to be indicative of anastomotic leaks but are currently not being assessed in the clinic.

Methodology

Our team specialises in artificial intelligence-based solutions for diagnosis of early infection. We determined a large range of soluble biomarkers in the drain fluid from the surgical site to predict complications, leaking bowel contents and signs of sepsis in patients recovering from their operations.

In collaboration with the company Olink in Sweden, optimal working conditions were identified for drain fluid to be used for such studies. Protein biomarkers that increased in levels in response to leaking bowels overlapped with those found with a much smaller biomarker panel used in a previous Accelerate-funded project.

A comparison with data from related projects shows that the biological pathways activated in patients are not specific to post-surgical complications (and the release of bowel contents), but are very similar to those of bacterial infections in other parts of the body.
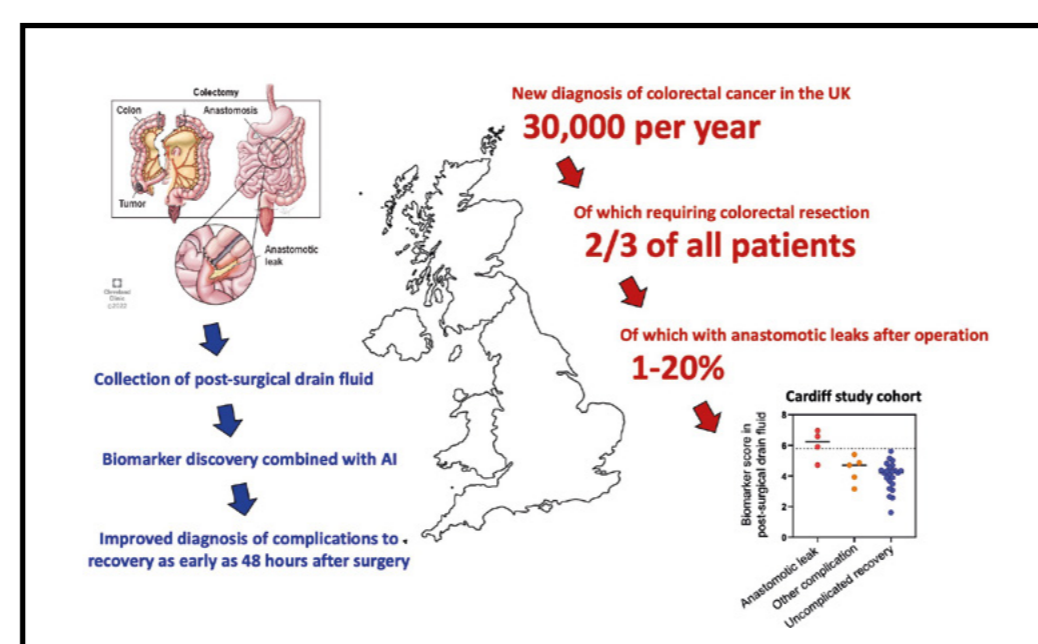
Benefits

- strengthening of collaboration with Siemens Healthineers
- pipeline for validation of existing biomarkers and identification of new biomarkers that merit development
- potential to leverage funding from industry and public funders
- contribution to consolidate Cardiff as Centre of Excellence in precision medicine and data innovation
- potential to inform development of point-of-care tests and clinical studies for biomarker-guided monitoring

Further exploitation/next steps

The project has substantial, multifaceted impacts. Most importantly for patients, early risk prediction and rapid diagnosis of surgical site infections will enable clinicians to treat or perform surgical repairs before overt infections become established, reducing the likelihood of life-changing sequelae such as sepsis in bowel cancer patients, and other patient undergoing abdominal surgery.

There is excellent potential for healthcare savings and for positive economic impacts across Wales. The combination of clinical and computational research and the analytical pipeline established in our team can be of use for different types of patients presenting with acute symptoms as already being studied in our team for patients with bacterial peritonitis (individuals receiving peritoneal dialysis as well as individuals with decompensated liver disease), neurosurgery patients, sepsis patients in intensive care and patients with suspected urinary tract infections.

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