EPD/24/19 - Novel non-invasive diagnostic imaging of endometriosis using total-body PET-CT.

Endometriosis is a disease that affects 1 in 10 women, is associated with debilitating pain and infertility and costs the UK economy 12.5 billion pounds each year. Currently, the only way to confidently diagnose most endometriosis is to perform keyhole (laparoscopic) surgery: in Scotland it takes an average of 8-9 years from first seeking help with symptoms to diagnosis. My fellowship project will determine if a new type of specialist scan, total-body PET-CT, can diagnose endometriosis without the need for surgery, accelerate diagnosis and support personalised treatment plans.
Endometriosis is where cells similar to those lining the womb (the 'endometrium') grow elsewhere in the body, forming 'lesions'. Most commonly the lesions grow on the lining of the pelvic cavity, called 'peritoneal' endometriosis. Lesions can also grow on the ovary, this is called 'ovarian' endometriosis, or form nodules, called 'deep' endometriosis.
Ultrasound and MRI scans can identify ovarian and deep endometriosis, but 80% of endometriosis patients have peritoneal endometriosis, which these methods cannot detect. Researchers have tested blood, saliva and urine as a way of diagnosing endometriosis, but so far, none of them are able to confidently identify or rule-out endometriosis.
PET-CT is a specialist scan that is commonly used to identify cancers which cannot be seen on other types of scans. PET-CT uses a 'tracer', a substance given into a vein which then accumulates in areas of disease. Two new PET-CT tracers have been developed: one that targets blood clots and another that targets cells which form scar tissue. Both blood clots and scarring are involved in endometriosis lesions. This is because the cells within endometriosis lesions respond to hormones in the same way as endometrium during the menstrual cycle, with repeated episodes of inflammation and bleeding. Over time, the endometriosis lesions develop scarring (fibrosis). A PET-CT scan using tracers that can detect both bleeding and fibrosis is ideal as it could identify both newly formed, and older, more scarred lesions as well as identify the location and type(s) of lesions. As a result, it could both diagnose endometriosis and guide treatment. Edinburgh has an international reputation for PET-CT research and has recently been awarded funding for a total-body PET_x0002_CT scanner (one of only three in the UK) which uses much lower doses of radiation than conventional PET_x0002_CT scanners, so is ideal for studies in reproductive-age individuals.
The overarching objective of my project is to determine if total-body PET-CT can identify endometriosis. To deliver on my objective, I will first use a combination of laboratory studies on peritoneal, ovarian and deep endometriosis lesions previously collected from patients who have had surgery. These will allow me to be confident that the targets for the radiotracers are found in all types of endometriosis, whether patients need to stop hormonal contraceptives before the scan, and if the scan needs to be timed to a particular time within the menstrual-cycle. I will perform PET-CT scans on patients with surgically confirmed endometriosis, and then on those

with suspected endometriosis who are due to undergo surgery. This will provide evidence of whether one, or both, tracers are able to detect all types of endometriosis, and if PET-CT can reliably rule_x0002_out endometriosis. I will interview my study participants (including those who do not want to take part) to understand their opinion on how acceptable this approach is for the diagnosis of endometriosis.

The outcomes of my fellowship will determine if PET-CT has the potential to be the future of diagnosis in endometriosis. This will mean patients can get earlier effective treatment, avoid unnecessary surgery and will reduce the socioeconomic burden of endometriosis on the NHS and UK economy.