Significance of Second Near-Infrared Region (NIR-II) guided tumour detection and surgical treatment using Carcinoembryonic Antigen-Related Cell Adhesion Molecule (CEACAM) targetted probe in colorectal surgery

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Respected Ma'am, According to WHO, cancer alone killed 10 million people in 2018., making it a leading cause of mortality worldwide[1]. Near-infrared fluorescence-guided surgery, a rapidly evolving technique, enables surgeons to assess tumour borders of various cancer types and lesions of other prevalent illnesses with great precision. Near-Infrared Region (NIR) radiation's ability to absorb energy at one wavelength and remit it at a different, longer wavelength stimulates substances to fluorescence, aiding the complete surgical removal of tumour tissues with negative margins, thus, improving the disease's prognosis and decreasing chances of reoccurrence[2]. Conventional fluorescence-guided surgery focuses on the first near-infrared window (NIR-I, 700–900 nm), whose tissue penetration is limited to a depth of only 1-6 mm. In contrast, the second near-infrared window (NIR-II, 1000-1700 nm) significantly reduces tissue absorption, autofluorescence, and photon scattering, enabling a deep penetration (up to 20 mm), micron-scale resolution, and an increased tumor-to-normal tissue ratio (T/NT) leading to more precise tumour removal[1–3].

A recent study in Beijing, China[3], has explored the value of the second near-infrared window (NIR-II, 1000-1700 nm) in image guided surgeries that uses 2D5-IRDye800CW, as a targeted NIR-II probe formed by the conjugation of 2D5-CEACAM5 nanobody (2D5)34 with IRDye800CW dye for intraoperative navigation in colorectal cancer which is the type of cancer known to have one of the highest mortality rates. To compare the efficacy of NIR-11 with that of NIR-1comparative studies were also conducted on mouse CA colon, orthotopic cancer and metastasis models. Compared to NIR-I, NIR-2 fluorescence had a much greater tumor to background ratio, the difference was statistically significant ($p<0.0001$) proving that the imaging probe was more sensitive in detecting tumours. This technique detected and resected tumours smaller than 2 mm, making it the most suitable option for cancer diagnosis and treatment[3].

Henceforth, it can be deduced that 2D5-IRDye800CW and NIR-II fluorescence collectively have the potential to act as a way of improvement in surgery of colorectal cancer. Studies have also demonstrated the use of NIR-II systems for imaging the vasculature, detecting sentinel lymph nodes, image-guided cancer surgery, and fluorescence endoscopy[4]. Its other good attributes include high precision during image-guided procedures, over currently used NIR-I radiations[3]. Finally, NIR-II fluorescence technique's crucial role in detecting and treating tumours, highlights its importance and warrants further advancement.

DOI: https://doi.org/10.47391/JPMA.9891

Disclaimer: None.
Conflict of Interest: None.
Source of Funding: None.

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Submission complete: 06-05-2023 **Review began**: 17-06-2023
Acceptance: 28-10-2023 **Review end:** 28-10-2023

Author's Contributions
FM and HK: Idea, conception, interpretation of the data, literature review, analysis, drafting, editing, proofreading.