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Systematic Review, Meta-analysis And Single-centre Experience Of The Diagnostic Accuracy Of Intraoperative Near-infrared Indocyanine Green-fluorescence In Detecting Pancreatic Tumours

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Background : During pancreatic resections assessing tumour boundaries and identifying the ideal resection margins can be challenging due to the associated pancreatic gland inflammation and texture. This is particularly true in the context of minimally invasive surgery, where there is a very limited or absent tactile feedback. Indocyanine green (ICG) fluorescence imaging can assist surgeons by simply providing valuable real-time intraoperative information at low cost with minimal side effects. This meta-analysis summarises the available evidence on the use of near-infrared fluorescence imaging with ICG for the intraoperative visualization of pancreatic tumours.

Methods : MEDLINE, Embase, and Web Of Science electronic databases were searched to identify manuscripts where ICG was intravenously administered prior to or during pancreatic surgery and reporting the prevalence of pancreatic lesions visualised through fluorescence imaging.

Results : Six studies met the inclusion criteria with a total of 64 pancreatic lesions in 61 patients. All were retrospective cohort studies. The most frequent indications were neuroendocrine tumours (NET) and pancreatic ductal adenocarcinoma (PDAC), followed by intraductal papillary mucinous neoplasm (IPMN). ICG fluorescence identified 48 out of 64 pancreatic lesions, with a PPV of 0.982 (95%CI 0.532-1) and a NPV of 0.2 (95%CI 0.077-428). The sensitivity in detecting pancreatic lesions was 0.788 (95%CI 0.361-0.961), and the specificity was 1 (95%CI 0.072-1). Sixteen out of 24 PDAC were visualised intraoperatively through ICG fluorescence, with a NPV of 0.333 (95%CI 0.131-0.624), a sensitivity of 0.562 (95%CI 0.159-0.897), and the specificity of 1 (95%CI 1-1). Twenty-one out of 24 NETs were visualised intraoperatively through ICG fluorescence, with a PPV of 0.913 (95%CI 0.711-0.978), and a sensitivity of 1.000 (95%CI 0.930-1). In our series, 6 patients underwent robotic pancreatic resection with the aid of ICG fluorescence. Four patients underwent distal pancreatectomy, one pancreaticoduodenectomy and one an anterior RAMPS for 2 IPMN, 1 PDAC, 1 NET, 1 pseudopapillary tumour and 1 serous cystadenoma. All patients received 5 mg of ICG intravenously during the procedure with the identification of in 5/6 lesions (83.3%) through positive or negative staining. In all cases a R0 resection was achieved.

Conclusions : ICG immunofluorescence in detecting pancreatic tumours showed good accuracy. Additional research is needed to define optimal ICG administration strategies and fluorescence intensity cut-offs.

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