Emerging role of iron oxide nanoparticles in the diagnostic imaging of pancreatic cancer: a systematic review

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Background/Aims: Pancreatic cancer is the fourth most common cause of cancer-associated death worldwide, with a five-year survival rate less than 5%. The poor prognosis is mainly due to late presentation in 80% of patients and its drug resistant nature. Most diagnoses are made using contrast-enhanced computed tomography (CT) or magnetic resonance imaging (MRI), which have a limited sensitivity of 76-86%. Iron oxide nanoparticles are increasingly used in the diagnostic imaging of pancreatic cancer, due to their ability to selectively target tumour cells thereby increasing image resolution. The aim of this study is to identify studies investigating the use of iron oxide nanoparticles in the diagnostic imaging of pancreatic cancer.

Methods: A systematic review was conducted using PubMed for records up to 2015. Search terms used included ‘iron oxide nanoparticles’, ‘pancreatic cancer’ and ‘imaging’. Results: Sixteen studies were identified evaluating the use of iron oxide nanoparticles in the imaging of pancreatic cancer in vitro and in-vivo animal models. Eight of these studies evaluated the use of superparamagnetic iron oxide nanoparticles (SPION), and showed SPION significantly decreases T2 and T2* relaxation times of tumour tissue, providing a high sensitivity for MRI. Similar results were seen in eight studies that investigated the use of iron oxide nanoparticles conjugated to other molecules including gelatin, survivin, chemokine-receptor-4, silica-gold, endothelial growth factor receptor, urokinase receptor activator, Clostridium and a sonic-hedgehog target. Conclusion: Iron oxide nanoparticles in the form of SPION or conjugates are biocompatible and effective at targeting tumour cells and significantly attenuate MRI signals in T2-weighted images of pancreatic cancers from a range of cell lines.