

EVALUATING CURRENT METHODS FOR ENHANCING CT IMAGING USING CONTRAST AGENTS

Introduction

Contrast agents are used as a tool to visualise soft tissue through Computer Tomography (CT) imaging. CT imaging is a noninvasive imaging technique and diagnostic tool that allows for 3D visual reconstruction and segmentation of tissues of interest. Contrast agents aim to aid the visualisation of soft tissue as it has a low attenuation, as some structures are unidentifiable without contrast enhancement. The most widely used contrast agent is iohexol which is a covalently bound triiodinated benzene ring modified with hydrophilic functional groups to facilitate solubility. Agents vary in composition from ring structure to variations in osmolality and viscosity, yet all effective agents share the same essential criteria: they must enhance visualisation, be non-toxic, soluble, have a high attenuation, be targeted and quickly dissipate. [1]

Research Methodology

A thematic literature review was undertaken in an effort to establish a more up to date database of key contrast agents, both past and present.

Relevant information was systematically collated into a spreadsheet to support the preparation of the final project paper. This database will ultimately form the basis of the final review paper as the first author, incorporating critical discussions and evaluations.



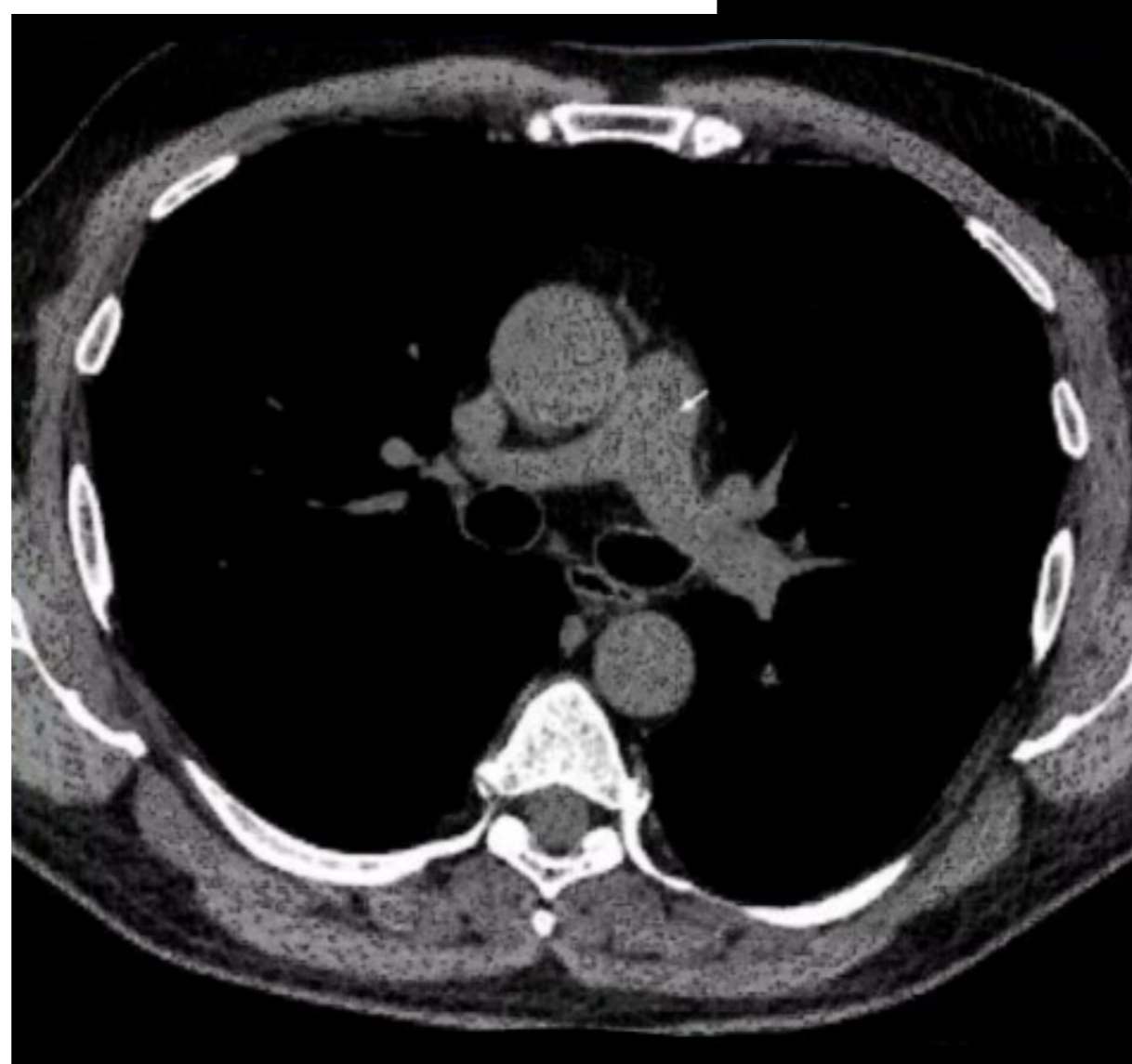
Objectives

The primary objective of the project was to:

- Systematically review and categorise the various contrast agents employed by clinicians and research groups.

The research aimed to identify key agents that have a large scale of potential. This could in turn contribute to more rapid innovation and translation of research.

The scans to the right show a chest CT scan with and without contrast enhancement. On the non-enhanced scan, the pulmonary artery appears grey like many other structures. However on the enhanced scan, the contrast appears white showing a blood clot (pulmonary embolism) [3].



The long term aim of this research is to **reduce health inequality** by optimising existing technology. Portable CT scanners once combined with effective contrast agents that **enhance the diagnostic information** obtained from a single scan, can provide greater clinical value in patient treatment. This advancement has the potential to enable earlier diagnoses, improve surgical planning, and support more effective treatment pathways. Crucially, the portability and efficiency of such systems could expand access to diagnostic imaging in **remote or resource limited settings**, increasing opportunities for timely and accurate healthcare delivery.

Results

Common Name	Base	Description
iohexol	iodine	Most widely used contrast agent, used by the NHS, injected in spine (intrathecal administration).
iodixanol	iodine	Second most widely used agent, available in private clinics in the UK. Used in head and body.
ioforminol (GE-145)	iodine	Has low osmolality and is non-ionic. Completed its phase II trial, a promising future agent.
liposomes/ethonised oil	lipid	Has a lipid bilayer surrounding an aqueous inner core, which allows it to target tissues effectively.
gold nanoparticles	gold	Has strong X-ray attenuation, prolonged circulation time and low risk of nephrotoxicity.
micelles	water	Molecules that encapsulate contrast agents in their hydrophobic core, enhancing circulation.
tantalum nanoparticles	tantalum	Cheaper than gold, one of the most viable elements for development, a promising new class.

Conclusions

While many novel contrast agents are under development, they are often expensive and difficult to obtain in clinical practice, particularly with limited healthcare funding. Further research could focus on repurposing discontinued agents, which may exist as unused stock within hospitals. Rather than being wasted, these agents could be assessed for alternative applications to improve diagnostic capability and resource efficiency.

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