

Describe an innovation/research area in interventional radiology and discuss its impact on current/future IR practices:

Embolisation for Mild to Moderate Knee Osteoarthritis: Is the Future Minimally-Invasive?

Cutting-edge – this term aptly describes the routine use of technologies in interventional radiology (IR) that are equal parts effective, delicate, and ingenious. As one such hallmark technology, embolisation procedures are frequently applied to intricate clinical problems; sclerotherapy for vascular malformations comes to mind. But could this technology help manage a chronic condition affecting millions in the UK and worldwide? Treatment of mild to moderate knee osteoarthritis (OA) is a novel and exciting use for embolisation therapy.

The massive physical, psychosocial and economic burdens of OA to the individual and society are well described.^{1,2} The knee is the most commonly affected site in people aged 45 and over; 1 in 5 in the UK seek treatment.³ Prevalence has mirrored increasing obesity rates.⁴ Regular non-steroidal anti-inflammatory (NSAID) therapy targeting generalised pain pathways is a mainstay treatment for mild to moderate disease with potential adverse effects. Management is especially challenging when pain becomes resistant to nonsurgical options but joint replacement, a successful yet invasive treatment for severe disease, is not yet indicated.⁵

Modifying OA-related angiogenesis, the growth of new vessels from pre-existing vasculature, could provide a unique pain relief solution for some patients with mild to moderate knee OA resistant to conservative management. Joint inflammation can stimulate unwanted angiogenesis in surrounding soft tissue, and angiogenesis can potentiate further inflammation. Local regulators within osteoarthritic chondrocytes and synovium mediate this vicious cycle.⁶ Importantly, innervation may accompany neovascularization. New nerves susceptible to compression and hypoxia are a hypothesized source of pain in OA that can persist even after joint inflammation has resolved.⁷ Consequently, embolising abnormal vessels may reduce joint pain and inflammation by reducing new innervation.

During embolisation procedures neovessels surrounding the knee, typically geniculate artery branches, are identified by digital subtraction angiography. Transcatheter embolisation is

performed using pharmacological agents and microspheres (imipenem/cilastatin sodium), with impressive early results.⁸ In a 14 patient case series, Okuno *et al.* reported rapid symptom improvements using an OA-specific scoring tool (Western Ontario/McMaster Universities Osteoarthritis Index; WOMAC). Most improvements were sustained at final follow-up (mean 12 ±5 months), with no major adverse events.⁹ A second study on 95 knees showed significant improvements (P<.001) in mean WOMAC scores at 24 months post-procedure. MRI assessment at 24 months using the Whole-Organ MRI Score (WORMS) showed significant improvement (P=.0016) in synovitis from baseline and no aggressive degenerative progression.¹⁰

Further investigation of long-term efficacy and safety is warranted, and a randomised controlled trial is ongoing.¹¹ Treatment cost also requires evaluation. Embolisation for knee OA was shown to be more expensive than NSAIDs but less than COX2-selective drugs when adjusted for expected future complication costs.⁵ However, comparison for quality-adjusted life years was not done.

Potential benefits of this innovation are inspiring; reduced analgesic use and, theoretically, slowed progression of some cases to severe OA requiring arthroplasty could improve quality of life, especially in non-surgical candidates. Future research will determine the role of embolisation in knee OA management, but who knows - the cutting-edge technology of IR may help ‘take the edge off’ this chronic pain.

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