

Intradialytic magnetic resonance imaging for research studies – a dialysis nursing perspective

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Background

Magnetic resonance imaging (MRI) provides the potential to perform high resolution imaging of the heart and brain without the need for intravenous contrast or exposure to radiation. Recent focus on the adverse effects of haemodialysis on cardiac and cerebral function suggests that intradialytic MRI may provide valuable new insights. However, the need to avoid metal objects within the scanner poses a substantial challenge to utilising MRI during dialysis. Here we describe the method we have developed to overcome these practical barriers and discuss our experience during a recent clinical trial from a nursing perspective.

Methods

We enrolled patients who were stable on chronic maintenance haemodialysis. Patients took part in a cross-over trial comparing changes in dialysate temperature, and as part of this underwent two study days in which multi-organ MRI scans were performed before, during and after dialysis. The MRI centre at the local university has a specifically designed unit able to perform MRI scanning during haemodialysis sessions. The dialysis machine is placed outside the MRI scan room and because the scanner room is shielded, the dialysis lines have to pass through a specific opening (waveguide) in the wall. This requires the use of long dialysis lines (2m). Water supply and drainage are positioned so that the dialysis machine can be as close to the external opening of the waveguide as possible. Non-metallic needles (silicone) were used for needling the fistula using the button-hole technique. A small team of nurses were trained in the use of non-metallic needles and thermocontrolled dialysis. For intradialytic MRI scans, a dialysis nurse or doctor remained inside the scanning room to monitor the patient and a technician remained outside the room to operate the dialysis machine. A doctor was present throughout the study day, who performed a detailed clinical assessment before and after dialysis. Between scan sessions, participants were moved from the MRI scanner to an MRI-safe trolley for comfort, while dialysis continued. Transport was arranged to and from the MRI centre and refreshments were provided during the long study days (8-9h).

Results

For this study 17 patients were recruited; two patients were transplanted mid-way through the study, two patients were withdrawn due to symptomatic intradialytic hypotension and one was withdrawn for medical reasons. There were some technical challenges including failure to cannulate (one participant) and MRI scanner fault (one participant) which meant we had to abandon the day and start the run-in period again. Most participants experienced no adverse events and we were able to successfully complete the protocol in twelve to achieve the recruitment target.

Conclusion

We have developed a method to safely perform intradialytic MRI which shows promise to improve understanding of the cardiac and cerebral impact of haemodialysis. Renal dialysis and research nurses were vital members of the larger team who supported dialysis treatments in this environment.