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International Journal of Surgery Case Reports

journal homepage: www.casereports.com

From ZeRO to HeRO: Saving lives one HeRO at a time



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ARTICLE INFO

Article history:

Received 17 June 2016

Accepted 1 August 2016

Available online 4 August 2016

Keywords:

Arteriovenous graft

Central venous stenosis

Dialysis

End stage renal failure

Haemodialysis reliable outflow graft

ABSTRACT

INTRODUCTION: This case report intends to highlight the Haemodialysis Reliable Outflow (HeRO) graft as a potential long term option for ongoing dialysis in patients with central venous stenosis.

PRESENTATION OF CASE: A 55 year old patient, who developed end stage renal failure (ESRF) after chemotherapy treatment for breast cancer, presented at the limit of her dialysis access after a 15 year haemodialysis history causing central vein stenosis.

The patient was initially started on peritoneal dialysis but after repeated peritonitis was switched to haemodialysis.

Over fifteen years of haemodialysis the patient had fistulae created in all four limbs. She had multiple tunnelled neck lines and developed an occluded left brachiocephalic vein and stenosed superior vena cava. Catheter dialysis via the right internal jugular vein was attempted but proved increasingly problematic due to poor clearances and frequent catheter changes.

A further attempt was made to treat with peritoneal dialysis, but again, this was unsuccessful.

As the patient had two failed attempts at peritoneal dialysis, had exhausted all her peripheral access options, and was having problematic catheter dialysis, she was offered the option of the HeRO graft as a 'last resort'.

DISCUSSION: The HeRO graft is a fully subcutaneous vascular access system that bypasses the central venous system providing haemodialysis access for patients with central venous stenosis. It consists of an arterial graft component and a venous outflow component, which are connected via a titanium connector. The central vein stenosis/occlusion is stented with insertion of the graft in to the right atrium, which is then secured to the arterial component for needling. So that successful dialysis could be completed as soon as possible post-operatively, the HeRO graft, in this instance, was combined with an immediate needling graft (Acuseal). This allowed the patient to receive successful dialysis within hours of completing the procedure.

CONCLUSION: This patient had reached the end of her haemodialysis life with no other options available. She was treated successfully with the HeRO graft, which at two months was patent and problem free. The patient had been able to return to work for the first time in 15 months.

Utilising the HeRO graft in this way may provide new, potentially long term, options for safe and effective dialysis in patients with central venous stenosis.

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1. Introduction

Central venous stenosis or occlusion is a very common problem associated with haemodialysis in patients with end stage renal failure (ESRF) [1]. Unfortunately, the loss of central vascular access correlates with a reduced life expectancy. The development of

central venous stenosis ultimately results in arteriovenous (AV) haemodialysis vascular access being lost and prevents the creation of new vascular access on the affected side.

Currently, guidelines recommend that all patients with ESRF who start haemodialysis should do so with an AV fistula in the first instance, an AV graft as second choice, a tunnelled venous catheter as a third option and finally, a non-tunnelled temporary catheter as an option of necessity only. Currently, there is no recommended option if all of the above fail, as happened to the patient in this case report.

The Haemodialysis Reliable Outflow (HeRO) graft is a fully subcutaneous vascular access system that bypasses the central venous system and so, is ideal for patients who have come to the end of their haemodialysis life span due to central venous stenosis. The graft aims to provide reliable, continuous blood flow directly from

Abbreviations: HeRO, haemodialysis reliable outflow graft; ESRF, end stage renal failure; AV, arteriovenous; FDA, Food and Drug Administration; TDC, tunnelled dialysis catheter.

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<http://dx.doi.org/10.1016/j.ijscr.2016.08.004>

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a target artery to the heart. Although classified by the Food and Drug Administration (FDA) as a graft, the HeRO differs from convention in that it has no venous anastomosis [2]. Instead, it consists of a venous outflow component connected (via a titanium connector) to an arterial graft component.

This case report intends to highlight the use of the HeRO graft as a further, or fourth, option in haemodialysis provision in patients with central venous stenosis and terminal access options.

2. Presentation of case

The patient was a 55 year old female who presented with ESRF following chemotherapy treatment for left-sided breast cancer. She had no other significant medical history.

The patient was initially started on peritoneal dialysis but suffered with repeated peritonitis and as such, was switched to haemodialysis. She was treated for 15 years using a combination of arteriovenous fistulas, grafts and finally central catheters. All four limbs were used during this time and multiple tunnelled neck lines sited. Ultimately, the patient developed occlusion of the left brachiocephalic vein and stenosis of the superior vena cava. Catheter dialysis via the right internal jugular vein was then attempted but proved problematic. Poor clearances and frequent catheter changes prompted a further, unsuccessful attempt to treat with peritoneal dialysis. In light of the patient's ever dwindling options, it was at this time that the patient was offered treatment with the HeRO graft as a last resort. Understandably, the patient agreed.

The HeRO graft was placed under general anaesthesia utilising percutaneous endovascular techniques. The venous outflow component of the graft was placed in the mid to upper right atrium via the right internal jugular vein using a standard Seldinger technique. The distal tip of the outflow component is placed so that it sits just beyond the cava-atrial junction. The arterial graft component is then tunnelled along the upper arm and the titanium connector on the end of the graft joined to the venous outflow component at the deltopectoral groove. The graft is then anastomosed to the brachial artery to complete the procedure. In order that the patient received successful haemodialysis as soon as possible, this new technology was combined with an immediate needling graft (an Acuseal). The patient received haemodialysis within hours of completing the procedure.

3. Discussion

The number of patients with end stage renal failure (ESRF) is increasing. The number of dialysis patients outliving their arteriovenous (AV) access is also increasing [3]. As such, clinicians are presented with the challenge of providing these patients with alternative, definitive AV access for ongoing, successful haemodialysis [4].

A particularly common cause of AV access failure is central venous occlusion and/or stenosis, with this reported in over 50% of all haemodialysis patients [1,3].

Historically, patients who have had failed AV fistulas and grafts have been offered tunnelled dialysis catheters (TDCs) [5]. However, TDCs are associated with high incidences of bacteraemia, poor patency and reduced blood flow rates and ultimately, increased morbidity and mortality [6]. Katzman et al. report a TDC bacteraemia rate of 2.3 per 1000 days and primary patency at 12 months (defined as the interval from the time of access placement until any intervention) of just 36% [7]. For this reason, they are only considered once all other options have been exhausted. They are currently the option of last resort.

With the development of the HeRO graft, patients that had otherwise exhausted their AV access and were either being considered

for a catheter or were already catheter dependent, an alternative for successful haemodialysis may be available. The HeRO graft may potentially provide long term, definitive access in an extremely challenging and complex group of patients.

A review of the literature highlighted that the HeRO graft, since its approval by the FDA in 2008, has been offered to patients with no option for further AV access and who are catheter dependent. In this case report, the patient had not only exhausted all options for AV access, including in the lower limbs, but had also attempted multiple catheters as well as peritoneal dialysis more than once. It is this type of patient that has presented clinicians with an almost impossibility—the surgical creation of further definitive vascular access in a population who have exhausted all other options.

Although only recently introduced for use in Europe, early studies suggest that the rate of complications associated with the HeRO graft are significantly less than those associated with the tunnelled dialysis catheter (TDC) [3–5]. A review of the literature suggests that rates of infection and bacteraemia associated with the HeRO graft are significantly less than those associated with TDCs and consequently, the rates of associated mortality are also less. A systematic review of the literature by Al Shakarchi et al. report device related bacteraemia (per 1000 days) of 0.13–0.7 and HeRO graft infection in just 10.1% (2.5–21%) [4]. When compared with the reported catheter-related incidences, it is evident that these values are significantly lower for the HeRO graft than they are for TDCs. This is in part due to the fact that the device is entirely subcutaneous and there is no external component to increase the risk of infection, as there is with the TDC [2].

As well as decreased infection rates, the HeRO graft also provides superior patency compared to TDCs, with results proving similar to those of the traditional AV grafts. Katzman et al. report primary patency rates of 38.9% for the HeRO device, with direct comparison to AV graft patency at 12 months of 42% [7]. Review of the literature by Al Shakarchi et al. showed a range of patency rates for the HeRO device of between 9.6% and 37.2% [4].

Other complications associated with TDCs such as thrombosis, steal syndrome and ultimately, central venous stenosis and/or occlusion have also been reported to be significantly less for the HeRO graft [4,6,7]. Both Al Shakarchi et al. and Katzman et al. noted low incidences of steal syndrome with percentages reported as 6.3% and 2.6% respectively [4,7].

The evidence currently available suggests that the HeRO graft is an invaluable, if not lifesaving, option for access-challenged patients and may provide a definitive and effective treatment for central venous stenosis [8].

4. Conclusion

Central venous stenosis is a devastating and often unavoidable consequence of long-term haemodialysis with very few options available to those patients affected by it. The HeRO graft may well provide an effective treatment for those patients who are out of options. As in this case report, the HeRO graft could be offered to patients who have reached the limit of their haemodialysis lifespan and are, for all intents and purposes, terminal.

This relatively new technology has opened the door to potentially long term options for safe and effective haemodialysis in patients with central venous stenosis and will no doubt revolutionise the lives of patients who have exhausted all other options and are reaching the end of their haemodialysis life.

Conflict of interest

The authors declare that there are no conflict of interest.

Funding

Funding of £250 provided for development of the poster related to this case report by Merit Medical. No other funding provided.

Ethical approval

Not applicable.

Consent

Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Charlotte Ratcliff – review of the literature and writing the paper. Monica Hansrani (consultant vascular surgeon) – performed procedure; proof read article.

Guarantor

Dr Charlotte Ratcliff and Miss Monica Hansrani.

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