CASE REPORT

Acute rehabilitation after resuscitative endovascular balloon occlusion of the aorta (REBOA) in major trauma

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SUMMARY

We report a 23-year-old woman admitted post cyclist versus heavy goods vehicle accident in December 2014. This was the second case the life-saving procedure, that is, resuscitative endovascular balloon occlusion of the aorta (REBOA) was performed on at the roadside. This advanced procedure was performed due to the extensive haemorrhage from this patient's complex pelvic fracture. As a result of REBOA, the patient consequently lost her left lower limb and underwent a variety of complex pelvic and lower limb surgeries.

The patient was admitted to the acute critical care unit and underwent repeated operations and was not ready to start active rehabilitation until 12 days into her admission. Prior to this she was on movement restrictions and received physiotherapy for limb care and dietetics in order to meet her nutritional requirements. The patient was stepped down to a ward setting and started on an extensive physiotherapy programme and was then transferred to the rehabilitation unit for amputees at Roehampton.

of REBOA and also how it is indicated in a large proportion of trauma patients admitted to MTCs.

The Royal London Hospital is one of the largest MTCs in Europe and receives over 56% of all major trauma cases within London. The prehospital care team is made up of some of the most advanced clinical experts within trauma care. Being able to perform life-saving procedures such as REBOA on the roadside is a huge development in major trauma care and could potentially reduce mortality rates for patients who experience uncontrollable haemorrhage post pelvic fracture.

Due to lower mortality rates patients are now faced with injuries that are life-changing. There are currently no formal rehabilitation guidelines to aid therapists with the management of these patients. Issues such as mobility, psychological impact, pain management, bladder/bowel management, returning to independent living and work need to be addressed during a patient's rehabilitation following the traumatic incident. The complexity of these unique patients involves advanced multidisciplinary teamwork with clear goals and outcome measures.

BACKGROUND

Pelvic fractures usually occur within major trauma high energy scenes in which urgent multidisciplinary input is needed.¹ Pelvic fractures are the third most common cause of death in motor vehicle accidents in the UK. Despite considerable changes throughout the last decade with the development of major trauma centres (MTCs), initial management and injury prevention, patient mortality rates post pelvic fractures remain high.

Resuscitative endovascular balloon occlusion of the aorta (REBOA) was first developed in the 1950s but was unsuccessful.² In recent years, it has been used successfully for different patients including patients with abdominal trauma, gastrointestinal bleeding or postpartum haemorrhage. On investigating the role of REBOA in pelvic fractures it has been concluded this procedure could be life-saving in the management of patients with uncontrollable haemorrhagic shock post pelvic fracture.³

A recent study investigated severely injured patients from the Trauma Audit and Research Network database who would have been theoretically eligible for REBOA. During 2012–2013 as many as 397 potential adult trauma patients were identified within a MTC setting.⁴ This provides a strong potential caseload use for the successful

CASE PRESENTATION

A 23-year-old media professional, involved in a cyclist versus a heavy goods vehicle accident on 12 August 2014. The patient presented with a severe pelvic injury with extensive haemorrhage. REBOA was performed by the Helicopter Emergency Medical Service (HEMS) at the roadside to prevent further bleeding. Her injury list is below:

- ▶ LC3 pelvic injury ([Figure 1](#))
- ▶ Left knee amputation (as a result of the REBOA procedure)
- ▶ Right femoral condyle fracture
- ▶ Right calf fasciotomy
- ▶ Extensive pelvic and abdominal packing

INVESTIGATIONS

On arrival the patient had sustained life-threatening injuries. The HEMS team decided to complete the second case of roadside REBOA to control the haemorrhage from the patient's pelvis. The patient was taken to an MTC where she underwent an emergency laparotomy, pelvis fixation, left knee amputation, right distal femur fixation and right fasciotomy.

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Figure 1 The patient's initial X-ray when brought into the major trauma centre illustrating the complex pelvic fracture.

TREATMENT

The patient was admitted to the acute critical care unit (ACCU) and was extubated 8 days later. No chest physiotherapy was required prior to or following extubation. On assessment, it was identified that the patient's main problems were pain, reduced active range of movement throughout the right leg and residual left leg, muscle weakness and fatigue. Issues were also identified with sleep and mood and the patient was referred for a psychological assessment on the ward. Her ACCU therapy rehab goals were to prevent nutritional deterioration and to be independent with sliding board transfer onto a wheelchair.

The patient was stepped down to the major trauma ward and received regular physiotherapy and occupational therapy. On initial contact the therapists introduced themselves and their roles. The patient was tearful during transfer and was unsure of what to do and what she could manage. Her family and friends were very supportive and visited daily. During the initial session it was discussed if the patient would benefit from psychological input, however the patient refused.

On assessment the patient had altered sensation (pain in the posterior aspect of the left thigh and throughout the right lower limb). The patient had active ankle dorsiflexion but no active inversion/eversion/plantar flexion in her right leg. Knee flexion was limited to 0–30° and decreased quadriceps, hamstring and gluteal muscle strength was observed in both limbs.

Week 1 to week 4

Transfer practice was carried out with slide board to wheelchair minimising assistance. While in the wheelchair the patient increased her sitting tolerance, started to complete functional tasks and wheelchair mobility skills. The patient completed a variety of amputee-specific exercises including upper limb exercises (with theraband and weights), core strengthening exercises, lower limb range of movement and strengthening exercises (restricted by weight-bearing status which was non-weight-bearing for 8 weeks). The patient also participated in muscle stimulation on quadriceps and gluteal muscles twice daily in order to increase her muscle strength and comply with her weight-bearing status.

Psychological input was again offered but the patient declined and remained in a low mood for 2 weeks. The patient however did engage in therapy sessions. Outcome measures were recorded including a personal diary, EuroQol five dimension (EQ5D) and the rehabilitation complexity scale (RCSE) wellbeing questionnaires.

Week 4 to week 6

The patient continued with transfer practice and sitting which she could now achieve independently. Strength and range of movement exercises were continued in the upper and lower limbs. There was continued use of muscle stimulator on both limbs in the quadriceps and gluteal muscles twice a day. The patient underwent a manipulation of her right knee under anaesthetic due to poor range of movement which increased flexion to 80°. The patient was able to participate in a specific amputee gym-based rehabilitation which improved her engagement and mood. However, rehabilitation was restricted by her non-weight-bearing status post pelvic fracture.

During this time the patient developed a right thigh seroma and had to have three separate theatre procedures to debride the wound and apply a vacuum pump over a span of 2 weeks, which had a negative impact on rehabilitation. A referral to the continence team was completed due to incontinence issues from a bladder injury secondary to the complex pelvic fracture.

OUTCOME AND FOLLOW-UP

During the patient's acute rehabilitation, the patient improved her ankle, right knee and hip range of movement and strength by completing exercises on a twice daily basis including muscle stimulation on her quadriceps and gluteal muscles. From week 4 the patient did not need a slide board to transfer and completed independent backward transfers. She was able to self-propel and to sit for up to 40 min. The patient's mood started to improve but she still became overwhelmed and tearful at times.

For longer-term progression the patient received amputee visitors from a local charity and the Roehampton referral was completed. An access visit to the patient's house was completed and equipment set up to allow the patient to be discharged home and await a rehabilitation bed at Roehampton. Finally a wheelchair referral was completed allowing her to have access to her own wheelchair to increase mobility and independence.

DISCUSSION

REBOA has been used successfully in MTCs within the last few years and research has proven REBOA to be a viable and safe method for managing catastrophic haemorrhage in trauma patients. However, rehabilitation with these patients is under-investigated and can be challenging due to the multifaceted needs of these patients.^{5 6}

From this case review it was important to focus on the acute pelvic rehabilitation rather than on the long-term amputee perspective. Weight-bearing issues played a large role in limiting acute rehabilitation but were overcome by using muscle stimulation and a bed exercise programme. Upper limb exercises were key as part of the rehabilitation in order for the patient to transfer and manoeuvre the wheelchair.

Rehabilitation with this patient group is essential within the acute stages and should be started immediately in ACCU. Chest and limb care should be completed while the patient is intubated during their critical care stay. Once the patient has been extubated the patient should be given a strengthening upper limb programme and sitting/transfer practice. The patient will face

Learning points

- ▶ The groundbreaking clinical practice of the first roadside resuscitative endovascular balloon occlusion of the aorta case completed.
- ▶ Long-term implications—amputation of left leg.
- ▶ Complex rehabilitation with significant muscle loss due to acute critical care unit stay and poor mobility.
- ▶ Significant rehabilitation required, limited by the weight-bearing status of the pelvic fracture and ongoing surgeries.
- ▶ Multifaceted issues including continence, psychology, physiotherapy, occupational therapy and amputee specialist rehabilitation units involved.

many issues such as pain, swelling, psychological trauma and further surgery which will impact on therapy progression.

Building a relationship between the patient and therapist with daily therapy sessions will enhance the patient therapy experience. Setting realistic weekly goals such sitting out in the wheelchair for half an hour per day and one long-term goal, for example, participating in specialist rehabilitation at Roehampton Hospital, is essential. These can be written up by the patient's bed to help remind them of their set goals. Involving family members is also essential for patient rehabilitation to help with exercises, taking the patient outside the hospital and to help motivate them when the therapy team cannot be present.

Self-management was essential towards this rehabilitation and could have a positive impact on the later stages of rehabilitation. The patient's EQ5D and RCES Scores improved from week 1 to week 6 with her self-perception and functional tasks, for example, washing and dressing. Another key aspect of the

Patient's perspective

My time at the Royal London is quite difficult to remember. I was on a lot of drugs and was having a hard time processing everything that had happened. The physiotherapy sessions were great as they made you feel like you were going some way to get better.

patient's care was the multidisciplinary approach with weekly meetings to discuss progress in all areas of the patient's care.

Limitations of the case report and acute rehabilitation of the patient include pain, weight-bearing status and swelling due to the complexity of the surgery and injuries. Continence became an issue in the later stages which affected the patient's mood and she often became withdrawn during therapy sessions. The patient's mood was also affected by the overwhelming experience and the life-changing injuries she now had.

Overall this was a challenging and new patient caseload from a therapy perspective. Advancing acute trauma care will continue to increase exposure to these types of complex patients. Acute rehabilitation is often overlooked due to the limitations of weight-bearing and levels of pain the patient can be experiencing, however, from this case report it is clear that there are a variety of rehabilitation options which can have a positive impact on later-stage rehabilitation.

Contributors JR contributed to reviewing the patient daily for rehabilitation and to the writing of the case report. KH contributed to the design and writing of this case study report. CD contributed to collating all the intensive care information and rehabilitation plans while this patient was in the major trauma ward. JC contributed to completing daily therapy sessions with this patient and referral to Roehampton. Contributions were also made by this author to the write up of this case report.

Competing interests None declared.

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