

# Case study: a non-healing diabetic wound treated with hyperbaric oxygen

## McCullough M

This case study was a winning entry in the inaugural Paul Hartmann /AWMA Advanced Wound Care Course Scholarships in 2006. Winners were chosen following a rigorous assessment process by the AWMA Executive Committee members and AWMA Education and Professional Development Subcommittee members.

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### Presentation

Mrs C was a 62 year old woman with Addison's disease and long-term insulin dependent diabetes mellitus. She was married with no family, did not smoke nor drink alcohol, and had a family history of diabetes mellitus.

Mrs C presented to the Wesley Centre for Hyperbaric Medicine with seven ulcers that had been present for 2.5 years. The ulcers had varied in severity over this time but were deteriorating rapidly after recent hydrocortisone injections to the wound beds.

### Medical history

Mrs C had an extensive medical history including diabetes mellitus, diabetic associated retinopathy, hypertension, Addison's disease and a raised cholesterol level. She had known peripheral vascular disease and had undergone a femoral popliteal bypass 4 years prior to the current presentation. She had had a revision of the graft 12 months later and the graft had recently been found to be partially blocked again. Past treatment of her ulcers had included hydrocortisone injections to the wound beds, but her current treatment regimen for the ulcers consisted of dressings only.

Medications being taken by Mrs C were Colgout, Florinch, Cortrate, Avapro, Somac and Zocor. She had a number of known allergies to some tapes and Indocin.

### Marcia McCullough

Wesley Centre for Hyperbaric Medicine  
Auchenflower, Brisbane, QLD  
Tel: (07) 3371 6033  
E-mail: Marcia64\_3@hotmail.com

### Wound profile

Mrs C presented for assessment of her diabetic related wounds and for assessment as a candidate for treatment with hyperbaric oxygen therapy. She was found to have multiple, seven in all, ulcers. They were located on both lower legs, on her calves and shins. Their sizes varied but the largest measured 45mm in length and 32mm in width. The wound beds were 100% soft fibrous slough. The bases, where visible, were deeply cyanotic. Wound odour was minimal; the exudate presented as moderate but it was controllable with daily dressings (Figure 1).

A wound swab taken at assessment grew *Staphylococcus aureus* with a moderate growth. An ankle brachial index (ABI) was not attempted due to the location and pain associated with the wounds. The pain was estimated by Mrs C as being between 3-5 using a scale of 0-10; 0 being no pain and 10 being the worst pain ever experienced.

The purpose of the initial assessment was to establish the level of oxygen present at the wound bed on air at surface pressure, and then to find a response to 100% oxygen also at surface pressure. This would indicate the response expected when the patient would be put under pressure. Mrs C's recordings at 15 minutes of room air were 67mmHg and 68mmHg at 1ATA, demonstrating a normal or expected level of oxygen within the tissue. However, when 100% oxygen was administered, her readings jumped to 338mmHg and 308 mmHg at 1ATA, indicating a very good response and a potential good outcome from hyperbaric treatment

### Aim

The aim of treatment became to safely administer 100% oxygen to Mrs C whilst under the barometric pressure of 2.4 bar for 2 hours per day, on a 5 day a week basis, for 20-30 treatments in order to facilitate wound healing.

## Management

Mrs C commenced treatment the following day. Commencing hyperbaric treatment required that Mrs C undergo extensive education regarding how to safely complete the sessions<sup>1</sup>. This education was undertaken by a certified hyperbaric attendant prior to the first treatment. Mrs C then joined a group of patients who had all completed their routine treatments under the care of a hyperbaric attendant and a qualified medical officer. Mrs C also was admitted to the wound clinic for care of her wounds whilst attending her hyperbaric treatment.

Her medical history was noted and recorded. The wounds were sketched, measured and photographed. Topics covering weekend wound care, showering with the wound, compression bandage, diet, zinc supplements and diabetic control were discussed. A care plan was also formulated.

The dressing care plans tend to be dynamic in nature and can be altered as often as the wounds require different dressing types. The wound nurse tends to undertake these decisions on a day to day basis, consulting with the medical officer as needed. The initial aim of the dressings was to hydrate the wound beds in order to facilitate manual and autolytic debridement.

The product used primarily was Intrasite conforming gel. Trial of both Tenderwet and Hydragauze also took place in this phase of treatment. Three weeks into the planned treatment, dressings were changed as indicated by the wound beds to Lyofoam and then Polymem. Later, whilst in outpatients, minor skin infections were controlled by using topical Bactroban and dressed as needed with Curasalt. The difficulty that Mrs C had had with tape allergies was overcome by wrapping the dressings in Webril. This, combined with a Tubigrip stocking, effectively kept the dressings in place as well as providing light

compression.

Early in Mrs C's treatment it was decided to involve an infection control specialist in her management. It was with his involvement in her care that a confirmation of *Necrobiosis lipidica diabetorum* was made. This condition begins as a raised shiny rash which progresses to open sores that are slow to heal. It occurs more frequently in women and is associated with diabetes. The treatment is difficult, although cortisone in tablet and creams have been of benefit in some cases<sup>2</sup>. This line of treatment had been tried by Mrs C and it had failed.

## Progress and follow-up

Mrs C was initially scheduled for 30 daily treatments. She responded slowly to the treatment, with one wound complicated when a fragile vein ruptured at a dressing change. This event required that the vessel be ligated. This particular wound had not responded at all to treatment up to this point, but then became one of the first to heal when the sutures were removed.

In response to the slow start but very promising progress shown at 30 treatments, the medical officer and Mrs C decided to continue a further seven treatments. At this time, five of the original seven wounds were completely healed (Figure 2). The remaining two ulcers, whilst still sizeable, had healthy pink granulation tissue at their bases and looked promising to go on to heal.

Mrs C moved to the outpatient department of the daily hyperbaric centre and attended twice a week for 2 months until complete healing had been achieved (Figure 3). At a recent social function that Centre hosted for past patients, Mrs C proudly displayed her 'new' legs which have remained completely healed.

Figure 1. Initial assessment.



Figure 2. Five of the seven wounds healed.



## Discussion

Hyperbaric oxygen therapy is an adjunctive therapy for the treatment of chronic diabetic ulcers. It involves the administration of 100% oxygen via an Amron Hood in a pressurised environment<sup>2</sup>. In the case at the Wesley Centre for Hyperbaric Medicine, the pressure for the routine treatment that Mrs C was being assessed for was 2.4 bar, or the equivalent of 14 metres under seawater.

When dressing chronic wounds like those that Mrs C presented with, it is not difficult to recognise the enormous emotional, social and financial impact that they make on the patient and their family. Mrs C was 'desperate' for something to fix her legs after 2.5 years of pain, dressings, doctor visit after doctor visit, injections and infections which had dominated her life. Just prior to her assessment for hyperbaric therapy, there had been talk of amputation which, in her case, meant bilateral amputation, and this horrified her. It is an unfortunate fact that there are times when the only option open to a patient is amputation of a limb, but that option should only be undertaken when all other avenues have been exhausted.

Mrs C presented with ulcers that were extremely cyanotic at the base and were very slow to respond to treatment in the early weeks. The turning point for her occurred when the vein ruptured and required ligating. After this event, this and all other wounds improved in colour and the slough build up declined from this point. The long-term result was complete healing.

Figure 3. Complete healing.



The exact reason why the vessel rupturing triggered a healing response is not known. However, it can be quite disconcerting when a vessel ruptures during the dressing procedure. The question to ask is could it have been prevented with different debriding techniques and dressings, or was the rupture inevitable?

Our reward was being able to witness the delight and pleasure that an otherwise quietly reserved woman had in having legs that were once again free of dressings. A lasting lesson learnt was to never give up and always work for the optimal outcome for the patient.

## Summary

Mrs C presented to the Wesley Centre for Hyperbaric Medicine for assessment of seven non-healing diabetic ulcers on both her lower legs. They had been present for 2.5 years, with treatment varying from dressings to antibiotics and hydrocortisone injections. Hyperbaric treatment commenced once her suitability was confirmed. All wounds were covered in slough with cyanotic bases.

The initial response to treatment was slow, but an improvement was noted after the planned schedule of 30 treatments. A further seven treatments saw five of the seven wounds heal, with the remaining two ulcers healing 2 months later.

## Recommendation

It is good to be reminded that there is never a single component to healing chronic wounds. The path is complex and involves many facets which are as individual as the patient themselves. All too often, hypoxia of the wound bed is overlooked or put in the 'too hard' basket. It can sometimes be the missing link which helps the other pieces of the puzzle fall into place. Fortunately, this was the case for Mrs C.

## References

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2. Dermatological Disease Database, *Necrobiosis lipidica diabetorum*, viewed 20 December 2005. [http://www.aocd.org/skin/dermatologic\\_diseases/necrobiosis\\_lipoid.html](http://www.aocd.org/skin/dermatologic_diseases/necrobiosis_lipoid.html)