

EDITORIAL FOCUS ON BURNS

The evolution of burn care research since the 2002 Bali bombing

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Looking back over the 20 years since the Bali bombing and trying to understand how burn care has progressed and changed, I should begin with taking the opportunity to acknowledge all those who responded to the disaster, striving to give the very best outcome for every single individual involved in this terrible event.¹ To really understand the national burn care response, it is important to look back beyond 2002 to the late 1990s, to the development of the AUSBURN PLAN.²

In the 1990s Woodside Petroleum was commissioning a gas production platform in the North West Gas Shelf, the North Rankin A, of similar configuration to Piper Alpha, an oil platform off the coast of Aberdeen Scotland. The Piper Alpha burns disaster, which occurred in the late 1980s, is well known to all burns clinicians as it resulted in the largest loss of life from such an incident.³ Woodside Petroleum approached the Burn Service of Western Australia (BSWA) to develop a disaster response plan gas shelf. The relationship between Woodside and the BSWA culminated in the state-wide burns disaster plan. The plan was implemented in real time as 'Exercise Icarus' and was refined before being taken to the Australian & New Zealand Burns Association (ANZBA), linking in all the multidisciplinary teams focused on burn care across the countries. The national approach was multi-agency, including federal and state health and Emergency Management Australia (EMA), in addition to the military. The result was a robust multi-stakeholder plan, AUSBURN PLAN,

highlighting how multiple, small multidisciplinary burn care teams across the country would come together to deliver a cohesive disaster response to a mass burn casualty.

In July of 2002, the AUSBURN PLAN was submitted to the Australian Health Ministers Advisory Council (AHMAC) for consideration of how Australia as a nation could respond to a burns disaster. The plan was accepted in August 2002 and then as a nation, the state burn services led the whole of community response to the Bali bombing in October 2002. Under the media spotlight, the window to our world opened and the community witnessed the response and the models of care (MOC) practised across the country, all striving to give the very best outcome for all those impacted by this terrorist event.

Twenty years later, reflecting on all the hard work that has been done, it is clear to me that we lived through an extraordinary time where our education and training afforded us the privilege of caring for not only Australian but

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international burn patients in large numbers. At that time and subsequently, the quality of the work undertaken by the 'extended burns team' including emergency, intensive care, anaesthesiology and many of our surgical, nursing and allied health colleagues meshed seamlessly with the specialist multidisciplinary burns teams, facilitated by our medical executives.⁴⁻⁷ The many invited presentations by the teams, both nationally and internationally, built upon the well-established reputation of ANZBA of striving for excellence. It was an opportunity for an enhanced understanding of the needs of burn care, with many facilities being refurbished over the following years across the country.

The core pillars of ANZBA of care, prevention, education and research were all under the spotlight and have continued to evolve over the last 20 years.⁸ The education of the general community in prevention and first aid has been shown to reduce the impact of injury.⁹ Engagement with industry and government policy continues to reduce injury and the extent of injury.¹⁰ Further, since the education program commenced in 1994, the emergency management of severe burns (EMSB) has provided the health community with insight into the concept that every intervention from the time of injury will influence the scar worn for life, and how to influence that outcome by practising the core principles of EMSB. The EMSB is taught across Australia and the world and continues to influence clinical practice.^{11,12}

Over the last two decades, there have been many areas of growth facilitating advancements in clinical care underpinned by research evidence. With the understanding that data is the future, the Burns Registry of Australia and New Zealand (BRANZ) was established in 2008 by the Victorian Burns team, is housed at Monash University, and has grown to be one of the premier sources of burns registry data internationally.¹³ The registry includes data from injury to outcome and forms the fundamental building block facilitating the understanding of the impact of burn injury and burn care.¹⁴ With more than 50 publications in the international peer-reviewed literature, it allows the members of the burns community to explore a diverse range of questions focused on improving outcome and generating hypotheses for further research.

Many of the state services have built specific databases with detail underpinning specific aspects of their MOC. In the BSWA, a Burn Clinical Outcomes

and Research Project (BCORP) was established in 2006. The database has allowed improved understanding of burn care interventions in the context of the injury and clinical outcomes.¹⁵ It is the exploration of data that has led to increased understanding of burn injury as a chronic disease. When an eight-year-old survived an 80 per cent full thickness body surface area (BSA) burn injury only to die three years later with a hepatocellular carcinoma, the question was asked, does surviving burn injury lead to an increased risk of malignancy?¹⁶ Data linkage provided the opportunity to explore this question. Using a database of 34,000 patients requiring admission for a burn injury since 1988, comparing them with 120,000 non-burn individuals with respect to age, sex, geospatial and socio-economic comparators, it was clear that surviving a burn injury does have an impact on life.¹⁷ Of note, 84 per cent of the adults and 96 per cent of the children in this database were not major burns; they had sustained burns less than 20 per cent BSA. Linking this data with a series of international classification of disease (ICD) coding groups, it was possible to establish that it was not only malignancy rates that change post-burn injury but many other conditions. It appears that having a prior burn injury will unmask the diseases of ageing.¹⁸ Understanding why and what mechanisms are underlying these changes and in which patients is currently involving many of our burns researchers. In collaboration across the country, there is work being undertaken on a multiple multi-omics approach to describe and understand the change we see in the paediatric burns population.¹⁹ This change is not only in the most severely scarred patients but often in those with no visible scar. As we move forward into the future, it is important that we understand who is vulnerable to such changes long term so that we can tailor therapeutic intervention to the individual to mitigate against poor outcomes.

Skin tissue engineering has been the subject of many advances from Australia over the last two decades with the development of products such as ReCell,²⁰ the point of care skin cell harvesting device, and the Polynova biodegradable temporising matrix BTM.²¹ In addition, the cell culture laboratories across the country, in collaboration with the burns teams, are forging ahead with new knowledge and understanding essential to our drive for improved therapeutics. The delivery of cells and skin matrices in the future may well involve the use of 3D printing solutions currently under development.²²

The range of cells and materials capable and useful in providing innovative solutions to skin loss are being investigated. Essential in being able to be taken from the bench to bedside is understanding the appropriate regulatory framework. Further, the work in skin engineering has the potential to impact beyond burn injury into restoration of skin integrity more generally.²³

In the past decades, much focus has been placed on scar reduction, including the time and technique of surgery, massage, pressure therapy and topical therapies such as silicone.²⁴ The burns community has embraced advanced laser technology, specifically the fractional laser, to reduce scarring. The micro-thermal zones induced by the fractional laser give the capacity for a secondary reorganisation and reduction of the scar.²⁵ Research is ongoing to understand the mechanism involved to optimise the intervention. Work has been undertaken looking at the chemistry of the skin and manipulating the collagen bonding and configuration to further 'unscar the scar'.²⁶ Scar reduction using a range of techniques, such as mechano-biology, chemical manipulation and controlled re-injury, are all areas of active research in Australasia with the aim to translate it to the clinical arena. The chemistry of the skin construct, the skin surface and potential plasma biomarkers are of interest when we are looking at identifying those at risk of poor clinical outcomes.²⁷ The use of real-time chemistry information may give us a capacity to augment our clinical decision making in the future with technologies such as the i-knife to improve accuracy of surgical debridement.²⁸

The understanding of the neurological response to burn injury, stress and pain provide further opportunities for innovative therapeutic intervention. The use of electrical stimulation of the peripheral nerve field can have an influence on the speed of healing.²⁹ The use of augmented reality distraction therapy has been shown to reduce the time to healing in children.³⁰ The central nervous system capacity for plasticity is associated with improved recovery potential.³¹ All are areas of research and translation in Australasia. Collaboration is a key feature of burns research,

with programs that involve children, including pooling of biobank samples and using negative pressure in the acute phase to reduce burn wound conversion and reduce the time to healing.³²

In conclusion, the burn community in Australasia has continued to grow, and is vibrant, highly specialised and focused on improving clinical outcomes. All the hard work and energy that the community witnessed in the aftermath of the Bali bombing in 2002 has continued to drive forward evidence-based clinical care learnings from today to improve tomorrow. I have witnessed the strengthening of the burns research community with collaboration into areas of advanced science and technology. This reflection on the research being undertaken across Australia and New Zealand is by no means exhaustive but gives an idea of the breadth of the endeavour. Understanding that there is an opportunity at every point of the clinical journey to translate improvements, to innovate and to underpin our future care with thoughtful research is essential.

In ensuring that the quality of the outcome is worth the pain of survival, there remains much to do in our quest for scarless healing post-burn injury. We now understand that the cutaneous scar is only one aspect of the total scar that our patients wear for life, which also includes both the psychological scar and the physiological scar. Understanding the impact of injury will give us an opportunity to explore the underlying mechanisms, which in turn gives us the opportunity to innovate to develop novel therapies. The translation from the bench to bedside relies on a robust education and training program. Further, our education needs to extend beyond the core multidisciplinary burns teams and needs to be linked to a robust disaster management plan.^{33,34} The currency of the AUSBURN PLAN 20 years ago demonstrated how we can work across boundaries, and prior planning paves the way to do so. It was a privilege to work with so many dedicated individuals at that time and to see what can be achieved together. It is also a privilege to be part of the burns research and innovation community which is continually evolving and collaborating. I am excited by what



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the future holds.

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