Anoxia

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Introduction

The brain requires a constant supply of oxygen to function properly. Deprivation of oxygen can result in permanent brain damage. This may occur during birth in which case survivors will probably be referred to services dealing with developmental problems and learning disability. Here, we are concerned with those requiring rehabilitation as a result of hypoxia (or anoxia) which happens *after* the perinatal period.

There are four different types of hypoxia according to the Brain and Spinal Cord Organisation (uploaded 2016). First there is anoxic anoxia; this occurs when there is not enough oxygen in the air for the body to benefit from it. The second type is anaemic anoxia resulting from an insufficient blood supply to the brain. This may occur after some types of lung disease. The third type is toxic anoxia, caused by toxins which prevent the blood's oxygen from being used sufficiently. Carbon monoxide poisoning, for example, may cause this. The final type is stagnant anoxia (or hypoxic ischaemia) whereby an internal condition blocks sufficient oxygen-rich blood from reaching the brain. This may happen after a stroke or cardiac arrest (ibid.).

The main causes are cardiac and pulmonary arrests, embolisms, attempted suicide (particularly with carbon monoxide poisoning), drug overdoses, hanging, near drowning, anaesthetic accidents, and oxygen deprivation as a result of stroke or traumatic brain injury (TBI). The most common cause of hypoxic-ischemic encephalopathy is cardiac arrest. The worldwide incidence of cardiac arrest in the general population is estimated to be around 1–2 /1000 persons per year but differs per country and region (Myerburg, 2001). Each year over half a million cardiac arrests occur in the United States. Approximately 380,000 of these occur outside of health-care facilities, and another 210,000 occur in hospitals every year (Go et al., 2013).

The rate at which different areas of the brain become damaged following a shortage of oxygen varies considerably. The most vulnerable areas are the 'watershed' regions of the cortex because the vascular supply is dependent on the furthest radiations of the cerebral arteries. Caine and Watson (2000) also found the basal ganglia to be susceptible to hypoxic damage. The areas involved in autonomic functions, on the other hand, are most resistant to shortage of oxygen. While all the various causes of hypoxic brain damage may be observed in brain injury rehabilitation centres, attempted suicide through carbon monoxide poisoning is probably the most common.

Cognitive problems faced by those with hypoxic brain damage

Cognitive problems are not uncommon after hypoxic brain damage. About half the survivors of cardiac arrest have cognitive impairment, and quality of life can be at risk (Moulaert et al., 2009; Saner et al., 2002). Emotional problems, such as anxiety and depression, are also frequently seen, as well as a reduced level of participation in society and a low return to work (Lundgren-Nilsson et al., 2005). Caregivers may also experience a high burden and they often have emotional problems, including symptoms of post-traumatic stress (Wachelder et al., 2009).

A variety of cognitive deficits may be seen depending on the extent and severity of brain damage, with memory and executive disorders being the most typical. Wilson (1996) found 33 per cent of 18 patients had both memory and executive problems as their major cognitive deficits, while Caine and Watson (2000) found 54 per cent of 67 patients had a memory disorder. Peskine et al. (2004) found executive problems in all 12 of their anoxic patients. The pure amnesic syndrome is also seen, although less often (only 13 or 19.4 per cent in the Caine and Watson review and only three, or nearly 17 per cent, in the Wilson sample). Visuospatial and visuoperceptual deficits may also result. Wilson (1996) found two patients had these problems in addition to their memory and executive problems, with another three patients having visual perceptual and visual spatial problems alone. Caine and Watson (2000) found 21 cases (31.3 per cent) with these difficulties. Disorders of recognition such as visual object agnosia and Balint's syndrome, of which the most striking deficit involves problems localising in space, are rare but when they are seen they nearly always result from anoxic or hypoxic brain damage (Wilson et al., 2005, 2009).

There is also a subgroup of people with cerebral hypoxia who have such severe intellectual impairment that they cannot be assessed with traditional neuropsychological tests and have to be assessed with tests for people with special needs. These comprised almost 25 per cent of the Wilson (1996) sample. Finally, there are those who remain with a disorder of consciousness (DOC) who are in a vegetative state (VS) or a minimally conscious state (MCS). Giacino and Whyte (2005) recognised that patients who are in a VS or a MCS following anoxic damage do less well than those whose DOC follows a TBI. In 2015 Dhamapurkar et al. (2015) found that 18 per cent of 28 people who had a DOC for 12 or more months recovered consciousness and that survivors of a TBI were more likely to show delayed recovery than non-TBI patients, most of whom had sustained hypoxic brain damage.

The emotional, psychosocial and identity problems faced by survivors mirror those found in survivors of traumatic brain injury (TBI), stroke and encephalitis. Thus, anxiety, depression and difficulties adjusting to identity change are frequently seen.

Treatment for survivors of cerebral hypoxia

The principles of rehabilitation for cognitive, emotional and psychosocial problems as discussed elsewhere in this book apply to those with hypoxic damage in the same way as they do to any other kind of brain injury. However, although cognitive impairments are common after cardiac arrest and affect quality of life, these problems often remain undetected by health-care professionals (Moulaert et al., 2010). Because a cardiac arrest can affect patients and caregivers in many different domains, there is an urgent need for an effective intervention specifically aimed at the consequences of the brain damage and not just the cardiac event. Two interventions were specifically developed for survivors of a cardiac arrest that had positive effects on mortality, physical complaints, mood, and knowledge about the cardiac event and its consequences (Cowan, Pike and Budzynski, 2001; Dougherty, Thompson and Lewis, 2005). In these interventions, specific attention was given to psychoeducation and emotional functioning, but not to cognitive problems. Recently, an intervention aimed at cognitive problems after a cardiac arrest was developed and evaluated in a randomised controlled trial (Moulaert et al., 2015). The intervention 'Stand still … and move on' consists of psychoeducation, cognitive screening, practical support for patients and caregivers, and referral to rehabilitation services if needed. Significant and clinically relevant improvements were found on emotional functioning, anxiety and quality of life, and patients in the intervention could return to work earlier. For an account of the rehabilitation given to three young people who sustained hypoxic brain damage for other reasons (one from carbon monoxide poisoning, one from near drowning and one from an anaesthetic accident) see chapters 3, 5 and 22 in Wilson (1999a–c).

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