

## Twenty five years of vascular trauma in Northern Ireland

### *Surgeons have learnt the value of intraluminal shunting*

Perhaps the quarter century of futile terrorism and internecine strife in Northern Ireland is coming to an end, leaving in its wake over 3100 people dead and 36 500 injured. The civil population and those defending it have endured physical suffering and grief with dignity and spirit, while the fabric of their lives has been blighted by the systematic destruction of their homes and places of work and leisure. The cease fire has generated a mixture of relief, scepticism and hope.

Belfast's largest teaching hospital, the Royal Victoria, took on the main responsibilities of a front line evacuation centre. Staff treated casualties, often from major disasters, while ensuring that specialist practice, undergraduate teaching, postgraduate training, and research continued undeterred. Despite witnessing horrific injuries and having little access to counselling they have remained uninured to pain and distress.

Over the past 25 years vascular surgeons in this province have dealt with an estimated 1500 injured major blood vessels.<sup>1-3</sup> Progress in managing vascular trauma has usually been made in wartime,<sup>4,5</sup> and this conflict offered unique opportunities.<sup>6-11</sup> In contrast with the situation on the battlefield, most casualties arrived within half an hour, including those with injuries to the major vessels, who otherwise would have died at the scene. The nature and severity of vascular injuries reflected the energy dissipated on impact by shrapnel (from bombs, mines, mortar shells, and rockets) and by high and low velocity bullets. Punishment shootings (or "knee cappings" in which the victim is shot in or near the knee at close range) accounted for many injuries to limb vessels.<sup>1-3 6-12</sup>

In high velocity injuries of the great vessels in the neck and superior mediastinum, repair was achieved because the airway had been secured early with a cuffed endotracheal tube and surgeons were prepared to proceed to median sternotomy.<sup>3 6 13 14</sup> Early repair of the carotid artery using shunts prevented cerebral infarction and occasionally reversed a developing neurological deficit. High velocity injuries of subclavian vessels presented a challenging test of technique in gaining access for control and repair, especially on the left side; as with injuries to the axillary vessels, damage to the brachial plexus was common.<sup>6 14 15</sup>

One in four patients with penetrating trauma of the abdomen also sustained intrathoracic damage. Fatal exsanguination from large vessels was prevented by vigorous resuscitation and definitive surgery; half of those with aortic

and caval injuries survived.<sup>6</sup> Control of the subdiaphragmatic aorta was an essential prerequisite to exploring an expanding retroperitoneal haematoma. In major injuries of the inferior vena cava—a valveless conduit draining systemic, portal, and hepatic flow—proximal and distal control was imperative, preferably around a shunt to ensure adequate venous return.<sup>16</sup>

Over the past 15 years routine intraoperative shunting of both transected artery and vein in vascular trauma to the lower limbs has improved management. The technique has been increasingly adopted abroad and continues to be studied experimentally.<sup>17</sup> Its value is especially borne out in complex wounds typified by concomitant arterial and venous injury, fracture and comminution of bone, severe disruption of tissue, nerve injury, and contamination. Striated muscle rarely survives warm ischaemia beyond 6 hours (this depends on the level of arterial injury, collateral flow, degree of shock, and vasoconstriction), and delays in diagnosis or vascular repair therefore carry a penalty. Duplex scanning is impractical in penetrating wounds, whereas angiography will competently delineate arterial injury: by excluding damage when clinical signs are equivocal it strengthens confidence not to intervene.<sup>11 18</sup> Ischaemia reperfusion injury increases capillary permeability, muscle swelling, and compartment pressure, thereby attenuating tissue perfusion sufficiently to invite the sequelae of the compartment syndrome, ischaemic contracture, ischaemic nerve palsy, aseptic muscle necrosis, and amputation.<sup>7-10</sup>

An awareness that time crucially affects outcome promotes hurry and leads to lapses in technique which may compromise survival of the limb. These lapses include vascular repair with lateral suture or end to end anastomosis under tension, interposition grafting with a vein of suboptimal calibre or length, ligation of a major vein, and disruption of a vessel repair by late fixation of a fracture.<sup>6-10 19</sup>

By halting the race against time intraluminal shunting has made these lapses less likely, and by introducing a logical sequence of steps it has encouraged a multidisciplinary operative strategy, improved the quality of operative technique, reduced complications, and kept amputations to a minimum.<sup>8-10</sup> An inlying shunt bridging a severed artery (or an outlying shunt when tissue loss is extensive) instantaneously revitalises the limb. A similar shunt reconnecting a severed vein restores drainage and reduces the need for

fasciotomy. Better demarcation of non-viable tissue makes for precise debridement, and only at this stage may discrimination between a potentially salvageable and an irretrievably damaged limb become clear. Restoration of skeletal integrity will safeguard subsequent vessel repair. The debate over whether artery or vein is repaired first is rendered obsolete. A compound vein graft, matching the calibre of the host vessel,<sup>1-3 6-9</sup> or an extra-anatomic vein graft bypassing an open contaminated wound may be constructed at leisure.<sup>9 10</sup>

These improvements in managing vascular injuries represent dividends from an experience in which the victims of inhumanity have been the key contributors. The hope remains that "one day the people of peace will come into their own in Northern Ireland."<sup>20</sup>

AIRES A B BARROS D'SA  
Consultant vascular surgeon

Vascular Surgery Unit,  
Royal Victoria Hospital,  
Belfast BT12 6BA

- 1 Livingston RH, Wilson RI. Gunshot wounds of the limbs. *BMJ* 1975;i:667-9.
- 2 Barros D'Sa AAB, Hassard TH, Livingston RH, Irwin JWS. Missile induced vascular trauma. *Injury* 1980;12:13-30.
- 3 Johnston GW, Barros D'Sa AAB. Injuries of civil hostilities. In: Carter DC, Polk HC, eds. *Surgery Vol 1. Trauma*. London: Butterworths, 1981:284-301. (International medical reviews.)

- 4 Hughes CW. Arterial repair during the Korean war. *Ann Surg* 1958;147:555-61.
- 5 Rich NM, Baugh JH, Hughes CW. Acute arterial injuries in Vietnam: 1,000 cases. *J Trauma* 1970;10:359-69.
- 6 Barros D'Sa AAB. A decade of missile-induced vascular trauma. *Ann R Coll Surg Engl* 1981;64:37-44.
- 7 Barros D'Sa AAB. How do we manage acute limb ischaemia due to trauma? In: Greenhalgh RH, Jamieson CW, Nicolaides AN, eds. *Limb salvage and amputation for vascular disease*. London: Saunders, 1988:135-50.
- 8 Barros D'Sa AAB. The rationale for arterial and venous shunting in the management of limb vascular injuries. *Eur J Vasc Surg* 1989;3:471-4.
- 9 Barros D'Sa AAB. Upper and lower limb vascular trauma. In: Greenhalgh RM. *Vascular surgical techniques*. London: Baillière Tindall, 1989:47-65.
- 10 Barros D'Sa AAB. Complex vascular and orthopaedic limb injuries. *J Bone Joint Surg [Br]* 1992;74:176-8.
- 11 Graham ANJ, Barros D'Sa AAB. Missed arteriovenous fistulae and false aneurysms in penetrating lower limb trauma: relearning old lessons. *Injury* 1991;22:179-82.
- 12 O'Reilly MJG, Hood JM, Livingston RH, Irwin JWS. Penetrating injuries of the popliteal artery. *Br J Surg* 1978;65:789-92.
- 13 Smith RF, Elliot JP, Hageman JH, Szilagyi DE, Xavier AO. Acute penetrating arterial injuries of the neck and limbs. *Arch Surg* 1974;109:198-205.
- 14 Barros D'Sa AAB. Arterial injuries. In: Eastcott HHG, ed. *Arterial surgery*. London: Churchill Livingstone, 1992:355-411.
- 15 Brawley RK, Murray GF, Crisler C. Management of wounds of the innominate, subclavian and axillary vessels. *Surg Gynecol Obstet* 1970;131:1130-40.
- 16 Halpern NB, Aldrete JS. Factors influencing mortality and morbidity from injuries to the abdominal aorta and inferior vena cava. *Am J Surg* 1979;137:384-5.
- 17 Walker AJ, Mellor SG, Cooper GJ. Experimental experience with a temporary intraluminal heparin bonded polyurethane arterial shunt. *Br J Surg* 1994;81:195-8.
- 18 Sirinek KR, Gaskill HV, Dittman WI, Levine BA. Exclusion angiography for patients with possible vascular injuries of the extremities—a better use of trauma centre resources. *Surgery* 1983;94:598-603.
- 19 Doty DB, Treiman RL, Rothschild PD, Gaspar MR. Prevention of gangrene due to fractures. *Surg Gynecol Obstet* 1967;125:284-5.
- 20 Eames R. *Chains to be broken. A personal reflection on Northern Ireland and its people*. London: Weidenfeld and Nicolson, 1992:176.

## Immunisation against chickenpox

### *Better to confine immunisation to those at high risk*

There are three main arguments for universal immunisation against chickenpox in childhood. Firstly, immunisation is good for the children who are immunised; secondly, it is good for immunocompromised children, who will be protected from exposure to children with chickenpox; and, finally, it is cost effective because fewer parents need to take time off to take care of children with chickenpox. In our view, these arguments are not powerful enough to justify universal immunisation.

The natural course of chickenpox is well defined. Most reported cases occur in children under 10, who usually develop a vesicular rash that erupts in clusters and scabs over one week and causes troublesome itching. It is often associated with mild fever and other systemic symptoms. In older patients pneumonia is the most common complication, but bacterial superinfection, meningoencephalitis, and glomerulonephritis may also occur. Death or long term illness from primary chickenpox in immunocompetent children is exceedingly rare. At present, then, chickenpox is a benign illness.

Chickenpox in adults may be much more severe. During the first two trimesters of pregnancy it may result in chickenpox embryopathy. In the last trimester it may result in neonatal chickenpox, which, if severe, may be associated with a mortality as high as 30%.<sup>1</sup> Immunocompromised patients are also at risk of serious infection. It is hard to isolate immunocompromised children from community outbreaks of chickenpox because children can transmit the disease several days before they become clinically ill. To protect immunocompromised children, doctors often recommend that healthy recuperating children should be kept out of school until all lesions have scabbed over, even if they do not feel ill.

The main problem with immunisation is that we do not know whether children who are immunised with chickenpox vaccine develop lifelong immunity. In immunocompromised

children immunity persists in most of those who have been immunised for at least six years,<sup>2,3</sup> but long term immunity is thought to require re-exposure to natural infection or reimmunisation. If the protective effect of immunisation wanes a programme of universal immunisation may create a population of adults who are at risk of serious illness and thus turn a relatively benign childhood illness into a major cause of illness and teratogenicity.

Most childhood immunisations, such as those against *Haemophilus influenzae* type b infection or pertussis, protect each child as well as promote herd immunity. Universal immunisation programmes benefit all children by protecting them from illnesses that can be severe in those who are young. Even if immunity wanes, infection during adulthood usually leads to less severe disease. By contrast, chickenpox in young healthy children is quite mild, whereas primary infection during adulthood can be severe. Thus the benefits to most children from chickenpox immunisation would be minimal: the benefits accrue only to immunocompromised children.

A programme of universal immunisation to benefit immunocompromised children would require doctors to ask parents to authorise the immunisation of their children not for their own benefit but for the benefit of their less fortunate classmates. Parents would be asked to place their children at potentially increased risk of primary chickenpox as adults. This is compulsory altruism. Given that we do not compel adults to serve as kidney or even blood donors, it seems unfair to require children to be "splendid Samaritans."<sup>4</sup> This also contradicts the "best interest of the child" standard, which is the usual guiding principle for parental decision making.

If the goal of chickenpox immunisation is to protect immunocompromised children other strategies should be used. One option is to immunise high risk children—and the chickenpox vaccine has been given successfully to immunocompromised children.<sup>5,6</sup> These children can be further protected by the use of varicella zoster immune globulin