NOTES ON THE 'EARLY' HISTORY OF BLOOD TRANSFUSION

A version of this document, written by Phil Learoyd, was originally provided as a hand-out at the British Blood Transfusion Society Annual Meeting of 2009

MYTHOLOGY

The Roman poet and writer Ovid (43 BC) in the 'Seventh Book of Metamorphosis' described how Media (a witch) rejuvenated Jason's father, King Aeson, by "*replacing his old blood*" with an elixir of *'...root-herbs, seeds and flowers, strong juices and pebbles from the farthest shores of oceans east and west, hoar-frost taken at the full of the moon, a hoot owl's wings and flesh, a werewolf's entrails, a fillet of a snake, the liver of a stag and the eggs and head of a crow, which had been alive for nine centuries'*.

Ovid

THE 'ROLE OF BLOOD'

Pliny the Elder (23AD-79AD) described how a person's 'life force', including their personality, qualities and strengths are present within a person's blood. This concept continued, i.e. Romans believed that drinking the blood of a slain gladiator would transfer their strength and bravery, and is continued to this day in the use of terms such as 'hot-blooded'. Egyptian kings believed bathing in blood to be a cure for elephantiasis, whilst Vikings drank the blood of seals and whales, as they believed it to be a cure for epilepsy and scurvy.

Pliny the Elder

THE FIRST RECORDED 'TRANSFUSION'

According to an ancient Hebrew manuscript, in order to try to cure NAAM (the King of Syria) of leprosy, his physicians...'*drew out the blood from his veins and put in that of another'*. Not surprisingly, he is then reported to have died, and as such it could be argued that this was also possibly the first recorded fatal transfusion reaction!

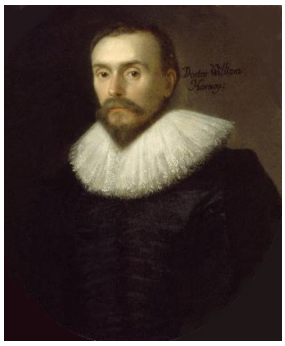
Pope Innocent VIII (Giovanni Cibo)

In 1492 Giovanni Cibo was dying from a chronic illness (possibly renal failure) that rendered him semi-comatose. After all means to revive the Pope had failed an 'infusion' was prepared by a 'mystic' (Abraham Meyre) from the blood of three 10-year-old shepherd boys (whose parents were paid one ducat each) reportedly obtained by cutting their carotid arteries. It is debatable however if the blood was actually 'transfused', however not surprisingly the three 'donors' died and the Pope's condition did not improve.

Pope Innocent VIII

17th CENTURY SCIENTIFIC DEVELOPMENTS

William Harvey (1578-1657) described the circulation of blood in the human body and the role of the heart, which was published in the book '*De Motu Cordis*' (1628). Sir Christopher Wren (1623-1723) and later Robert Boyle (1627-1691) 'injected' a variety of substances into the veins of dogs during 1665 and subsequently described the possible medical use of transfusion.



William Harvey

Sir Christopher Wren

Robert Boyle

Dr RICHARD LOWER (1631-1691)

Richard Lower performed the first dog-to-dog (direct artery-to-vein) transfusion in England at the Royal Society in 1666 and was the first person to write about the possible benefits of transfusion for treating haemorrhage. He later transfused Mr Arthur Coga, who was '*hired for twenty shillings'* (and described by Pepys in his diary as being '...*cracked a little in the head'*) with about 12 ounces *(approx. ¾ pint)* of lamb's blood (on two separate occasions) using quills and silver pipes. The first transfusion experiment was preformed at the Royal Society (London) on the 23rd November 1667.

Richard Lower

Dr JEAN-BAPTISTE DENIS

Dr Denis was one of the physicians to King Louis XIV of France. He performed a total of five transfusions on four different patients, the first on the 15th June 1667, using the blood of animals. He used animal blood because he said it was, '*less likely to be rendered impure by passion or vice*'. He transfused one of his patients, Antoine Mauroy (who was suffering from a '*severe phrensy caused by a love affair*') on two occasions with calf's blood. A third transfusion was attempted and even though unsuccessful the patient died the following day. Many Parisian physicians opposed the use of transfusion as the accepted 'treatment' at that time was blood letting and they encouraged Mauroy's wife to accuse Dr Denis of murder. Although the subsequent court case identified that she had in fact poisoned her husband with arsenic and that Denis was innocent, the 'court scandal' and pressure from other physicians resulted in the Faculty of Medicine in Paris issuing a decree in 1668 'forbidding the practice of transfusion'. In 1678 the French Parliament issued an edict stating that performing a transfusion was a criminal act and the Royal Society in London subsequently outlawed transfusion in the same year. As a result, transfusion was not performed for nearly 150 years.

Jean Denis

17th CENTURY TRANSFUSIONS - SUMMARY

- Performed without any knowledge of cross-species immunity.
- Used as a cure for 'illness', normally related to the transference of such things as personality, vigour and youth, rather than as a form of treatment for blood replacement.
- Lack of practical / functional transfusion equipment (i.e. use of quills), which was a direct artery-to-vein method, as no practical method of anticoagulation was available.

19th CENTURY DEVELOPMENTS – JAMES BLUNDELL

Dr James Blundell (1790-1877) was a noted and one of the outstanding obstetricians of his day who re-awakened interest in the use of blood transfusion following an extensive series of experiments on animals. Blundell initially became interested in transfusion as a method of treating post-partum haemorrhage, being *"appalled at my own helplessness at combating fatal haemorrhage during delivery"*. He advocated the use of human rather than animal donor blood, though his reason for doing so at the time was somewhat less than scientific, stating: *'What is to be done in an emergency? A dog might come when you whistled but the animal is small; a calf might appear fitter for the purpose, but then it cannot be taught to walk properly up the stairs.'*

Dr James Blundell

James Blundell and his colleague Henry Cline performed the first human-to-human transfusion on the 26th September 1818 in London using an ox-ureter (as tubing) and crow quills (as needles). Blundell argued that transfusion should be used for the treatment of desperately ill patients and performed ten transfusions between 1818 and 1829 with no more than four being successful (though two of the patients were already dead before the transfusion commenced!).

He subsequently described a transfusion (using a syringe) on a woman who was dying from post-partum haemorrhage in 1829 in *The Lancet*. Following the transfusion the patient recovered and Blundell states that she *'... expresses herself very strongly on the benefits resulting from the injection of the blood; her observations are equivalent to this – that she felt as if life were infused into her body'*. Blundell however also reported that some of his patients *'...suffered fever, backache and passed dark urine*', i.e. what would now be recognised as a haemolytic transfusion reaction.


THE LANCET.

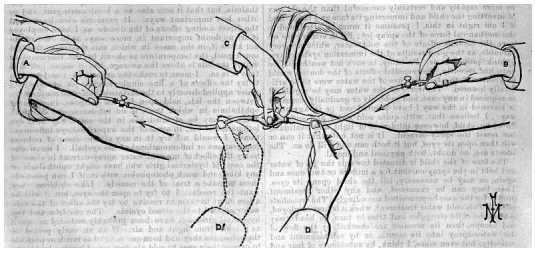
James Blundell's article

WERE EARLY TRANSFUSIONS A SUCCESS?

In 1849, Routh reviewed the outcomes of published transfusions in an article entitled *'Remarks statistical and general on transfusion of blood'*. Of the 48 recorded transfusions there were 18 fatalities, a survival rate which Routh noted was *'...rather less than hernia or the same as the average amputation'*. Some of the deaths were obviously not directly due to the transfusion but to the underlying condition of the patient, but they were performed with no knowledge of ABO incompatibility due to random donor selection (including immune species differences), the problems of air infusion, blood clotting or the need for aseptic techniques.

DIRECT ARTERY TO VEIN TRANSFUSION

Dr J.H. Aveling described his direct artery-to-vein transfusion equipment in an article published in 1873. It consisted of a simple tube with a central rubber bulb – a pumping action being produced by squeezing the bulb together with the tube on either side of it. He also stated: *'I have carried the apparatus around in my pocket to every confinement I attended for eight years until at length the opportunity for using it arrived'*.



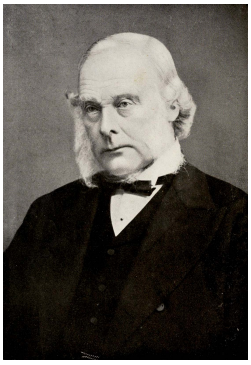
Aveling's direct transfusion apparatus

SOLUTIONS TO SOME OF THE PROBLEMS – 'INTO THE 20th CENTURY'

INFECTION

- Louis Pasteur (1822-1895) – recognition that bacterial / fungal contamination causes putrefaction.
- Joseph Lister (1827-1912) – the use of antiseptics.
- Sterilisation of instruments and the introduction to aseptic methods.

Louis Pasteur



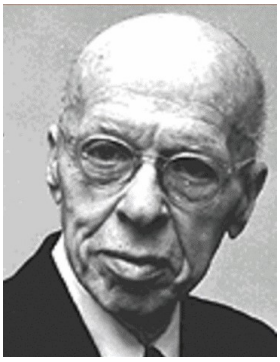
Joseph Lister

ANTICOAGULATION

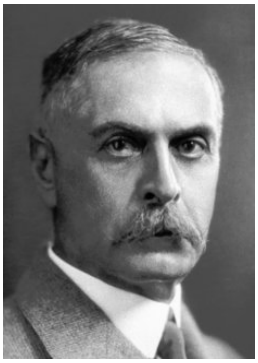
The initial method used to anticoagulate blood was defibrination. This was complex (mixing) process designed to remove fibrin/platelet clots that was difficult to perform, especially with larger volumes of blood and as a consequence was thought not always successful. In 1915 Dr Richard Lewisohn published his research in the USA on the optimal dose of sodium citrate needed to produced anticoagulation (though this discovery was also simultaneously and independently described by Albert Hustin in Belgium and Luis Agote in Argentina). Rous and Turner later used glucose to improve red cell preservation but it was not until 1943 that Loutit and Mollison described the acid-citrate-dextrose (ACD) anticoagulant solution for the storage of blood.

INCOMPATIBILITY

Ponfick reported the dangers of transfusion between species in 1874 (i.e. inter-species incompatibility), whilst Landois published details of the effects of cross-species experiments in 1885 – work which was ignored by many people who continued to use animals as blood donors for many years. Subsequently Dr Karl Landsteiner published the discovery the A, B and O blood groups in 1901 (group AB was discovered in 1902 by Sturli and von Decastello), though the true significance of this work to blood transfusion was not generally appreciated until 1911 when Dr Reuben Ottenberg identified the need for pre-transfusion ABO testing of the donor and recipient together with a serological 'cross-match' test.



Richard Lewisohn



Karl Landsteiner

Reuben Ottenberg