INTRODUCTORY NOTES

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As the title identifies, the content of this article is solely about the work of British researchers in the development of blood transfusion and as such the life and work of James Blundell is given due prominence. This article however also provides a valuable source of information regarding the contributions made by Alfred Higginson, James Aveling, Graily Hewitt and Robert McDonnell, as well as summary information of the work of a variety of other people in Britain who designed different types of blood transfusion equipment or proposed methods of anticoagulation – something that was prevalent towards the end of the 19th century – as methods of improving blood transfusion techniques.

THE BRITISH CONTRIBUTION TO BLOOD TRANSFUSION IN THE NINETEENTH CENTURY

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At the beginning of the nineteenth century the use of blood transfusion as a practical therapeutic aid lay discredited and almost forgotten in both Europe and America. The experiments of Dr. Richard Lower of Oxford (Gunther, 1932), started almost 150 years before in 1665, had stimulated widespread interest in the subject and many had copied his work. Principal among these was Denis, of Paris, whose first blood transfusion upon a human patient in 1667 anticipated that of Lower on the celebrated half-crazy Bachelor of Divinity, Arthur Coga, by only a short space of time. This new operation raised high and extravagant hopes of benefit to mankind; hopes recorded by Samuel Pepys in his diary (Braybrooke, 1906), but hopes which were, as yet to prove false. Lower and his contemporaries failed in part at least because of their ignorance and misunderstanding of the physiology of the blood and their misconception of the therapeutic role of blood transfusion. The belief was firmly held at this time that disease, both physical and mental, was associated with changes in the blood, and transfusion, after preliminary bleeding, was used to replace bad blood with fresh blood, thereby, it was believed, improving the state of the patient. So the madman was bled and then transfused with the blood of some docile animal, such as a sheep or calf, in the hope that he would take on the docile demeanour of the animal used. The senescent was similarly bled and his aged blood replaced in part by the blood of a young animal so that he might be rejuvenated. Not only was their conception of the role of transfusion incorrect but, in the light of modern knowledge, it

was inevitable that the transfusion of animal blood into human patients must, sooner or later, end in disaster, and as a result of such disasters the operation was discarded.

There it was to remain for a century and a half until the animal experiments and findings of Leacock (1817) stimulated interest anew. From his investigations he formed the opinion that blood of the same species should always be used in transfusion and, further, he saw the operation as a means of saving life in severe haemorrhage, concluding: "The consequences of haemorrhages, where the functions are not dangerously affected, do not of course require transfusion . . . but when a parturient woman trembles on the brink of the grave, from a uterine haemorrhage; or when a soldier is at the point of death from loss of blood, what reason can be alleged for not having recourse to this last hope, and for not attempting to recruit the exhausted frame, and turn the ebbing tide of life." Leacock's first conception that only similar or homologous blood should be used was revolutionary and his second, that the principal indication for blood transfusion was the replacement of blood lost in severe haemorrhage, almost equally so, differing, as it did, so much from the practice of the seventeenth century. A young London obstetrician of this time, James Blundell (fig. 1), was inspired by Leacock's work to investigate the subject himself. Born in London in 1790, Blundell became in due time a student at the United Hospital of St. Thomas and Guy and there included among his teachers his maternal uncle, Dr. Haighton, Lecturer in Midwifery and Physiology. He completed his training in Edinburgh, graduating from there in 1813, and returned to London the following year to become a Lecturer in midwifery in his uncle's department. He later succeeded to the Lectureships in Midwifery and Physiology at the United Hospital on the death of his uncle in 1818 and held these appointments until an unfortunate dispute led to his resignation in 1834. He continued, however, to carry on a large and apparently lucrative private practice and died in 1878, leaving a fortune of over half a million pounds (Brit. med. J., 1878).

Fig. 1: James Blundell, M.D., F.R.C.P.

Blundell was appalled, like so many others, at the tragic loss of maternal life as the result of haemorrhage in childbirth. The treatment available early in the nineteenth century was more a matter of despair than of effective therapy. Ergot,

though known since ancient times, was not used in obstetrical practice till 1807, when Sterns introduced it to the profession in America as "pulvis parturiens" (Thoms, 1931), but obstetricians in this country were denied its aid in the treatment of postpartum haemorrhage until nearer the middle of the century. Against this background of helplessness and tragedy in the face of haemorrhage, Blundell, searching for a means of effective treatment, adopted blood transfusion after careful preliminary animal experiments had placed it upon a more scientific basis. His work stimulated interest in the subject both at home and abroad. In this country he was the first of a long line of medical men, mostly obstetricians, who through the course of the century were to use blood transfusion either in the way he described or in a modified form.

His experiments (Blundell, 1818, 1824) showed that a dog bled almost to the point of death could be restored to active health by transfusing it with the blood of another dog, and further he demonstrated that if an exsanguinated dog was transfused with sheep's blood it usually died, even though the operation was attended initially with apparent recovery. A variety of methods of resuscitation after exsanguination were tried. First, transfusion from artery of donor to vein of recipient by means of a cannula. Second, by collection of donor blood in a vessel and its injection by syringe into recipient vein. Third, having satisfied himself that blood was not much vitiated by collection outside the vessels, he constructed an apparatus which incorporated a syringe for use in the transfusion of venous blood (fig. 2). This apparatus may well have been used for his earliest human transfusion and it certainly formed the basis for his later transfusion instruments. Like Leacock, he was convinced that for safe transfusion, blood of the same species must be used, saying "As it is clear from the preceding experiments that the blood of one sort of animal cannot with impunity be substituted indifferently and in large quantities for that of another sort of animal; it follows that in performing the operation of transfusion in the human body, the human blood alone be employed", and that the first and most important function of transfusion was to replace, in sufficient quantity, blood lost by haemorrhage. These experiments revealed how careful and painstaking an investigator Blundell was and with the work of Lower and Leacock constituted one of the first systematic researches in blood transfusions.

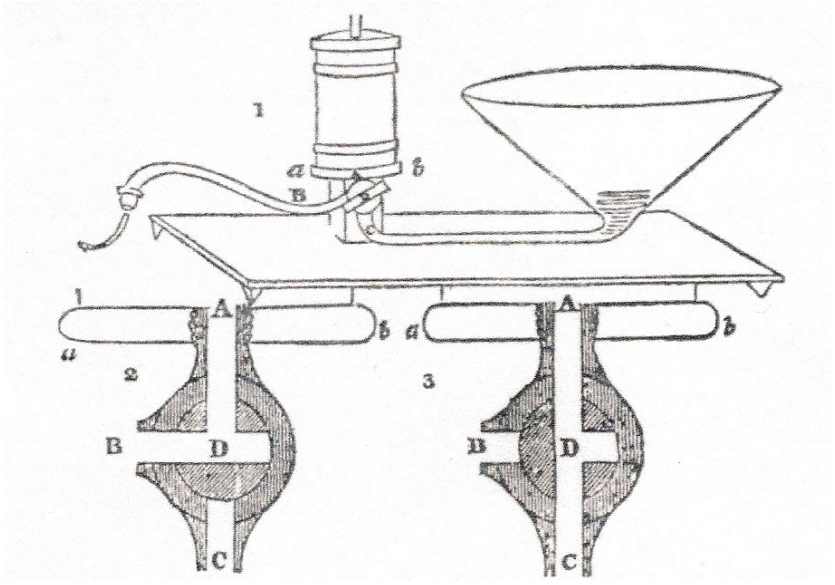

Fig. 2: Blundell's first transfusion apparatus
1 exhibits the syringe, collecting cup, etc.
2 and 3 (below) show the structure of the two-way tap ADC

Actually, although primarily interested in obstetrics, the first case to whom he transfused blood was not an obstetrical one but that of a man "in extremis" suffering from "scirrhosity of the pylorus" and although there was transient improvement after 12 ounces had been given, the patient died. Blundell was not discouraged by this failure but continued experiments to perfect his apparatus, producing a new instrument which he named the "Impellor" (fig. 3). This consisted of an outer compartment (ADB) which formed a water bath surrounding an inner cup (C) for receipt of the donor's blood and a syringe (L). The water bath was filled with what Blundell described as "milk warm" water (96°F) and before use air was displaced from the tubing and cannula by pumping warm water through the apparatus. For the operation, the donor was seated in a chair, to which the Impellor was clamped (fig. 4).

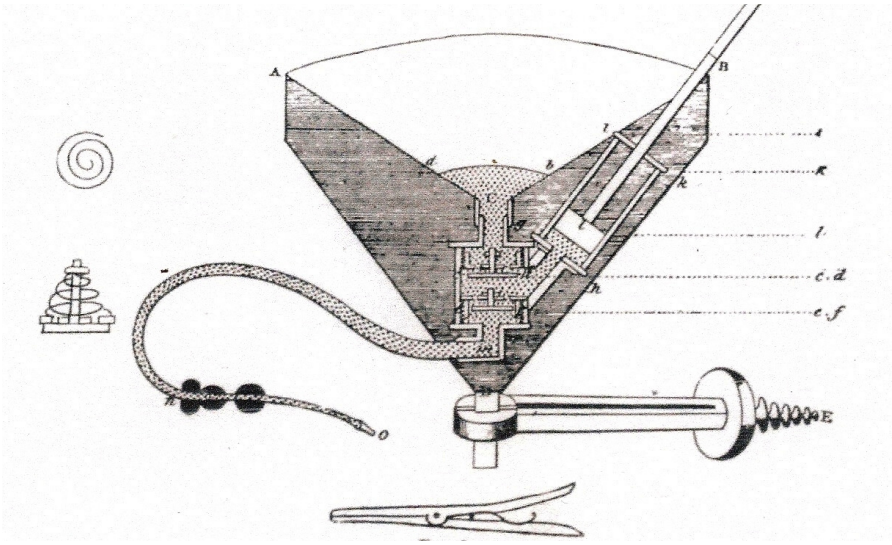

Fig. 3: The Impellor

Fig. 4: The Impellor clamped to the chair

Blundell advised male rather than female donors, since they were less likely to faint and also bled more freely. To aid bleeding he advised the administration to the donor of a quantity of "spirit sufficient to arouse the circulation", but since it was often difficult, in spite of this, to obtain sufficient blood from one donor he liked to have a second and even a third available to add their blood if required. The Impellor appears unnecessarily complicated, but since it was thought that the admission of the smallest quantity of air might be attended with fatal results, Blundell's aim was to construct an instrument in which this would be impossible. Exposure of blood to air for even a short space of time and contact with foreign surfaces was thought at first to deprive it of its vital properties, but later, after the construction of the Impellor, Blundell modified his views and did recommend, both for portability and simplicity, the syringe as a means of transfusion, saying: "If it is hereafter shown that blood can lie in the cup for several seconds without becoming unfit for the vital purposes, transfusion by syringe may be used." Many members of the profession remained sceptical of the value of transfusion and many declared it dangerous. Of the latter, Blundell said (Castle, 1834a): "Against this operation it may be urged . . . that it is not without its danger; and it may be so. But this is no reason why we should lay it aside. As, then, every operation we perform is attended with more or less danger, unless it be proved, which it cannot, that the injection of blood is attended with more surgical danger than ordinary, why should we urge this as an objection against transfusion?"

Fig. 5: The Gravitator

Unfortunately, as was inevitable, reactions followed transfusions in some cases and although no fatalities were reported, the case of those opposing transfusion was greatly strengthened. In the absence of knowledge of haemo-agglutination, these reactions were for the most part attributed to contamination of the blood in its progress through the transfusion apparatus and in 1828 Blundell introduced the "Gravitator" (figs. 5 and 6) in an endeavour to reduce this risk, saying: "In the present state of our knowledge respecting the operation although it has not yet been shown to have proved fatal in any one instance . . . it seems right . . . to confine transfusion to those in which there seems to be no hope unless blood can be thrown into the veins. The object of the Gravitator is to help in the last extremity by transmitting the blood in a regulated stream from one individual to another with as little exposure as may be to air, cold and inanimate surface" (Blundell, 1828-9). Besides the risk of reactions or the injection of air into the veins, the transfusionist of those days,

ignorant of aseptic techniques, had to contend with the not infrequent occurrence of thrombophlebitis in the arm of the recipient. In one case at least, Blundell applied leeches to the patient's arm after transfusion in an endeavour to prevent this complication.

Besides performing transfusion in his own private practice, Blundell was called to do so in consultation (Waller, 1825). Yet, although he was considered an authority on the subject it is probable that the total number of times he used this method was very small, since the operation was a rarity only used in desperate cases. Indeed, it was of such rarity and yet thought to be of such moment that it was not unusual in those days to publish the results of a single case. Soden (1852) was only able to collect thirty-five cases of blood transfusion carried out for obstetrical haemorrhage over the preceding twenty-seven years. These were taken from British, American and Continental literature. Jones and Mackmull (1928), writing on Blundell's contribution to transfusion, state: "A careful search of the literature only revealed ten recorded transfusions performed by Blundell." Of these, five were described as successful, but of the remainder, one, his first case, was dying from cancer, two were probably dead before transfusion was commenced, and a fourth was suffering from puerperal sepsis. He taught that it was not necessary to replace all the blood lost to satisfactorily resuscitate a patient: "From what little I have observed, however, I should suppose that from half a pint to a pint may be considered as a very ample supply."

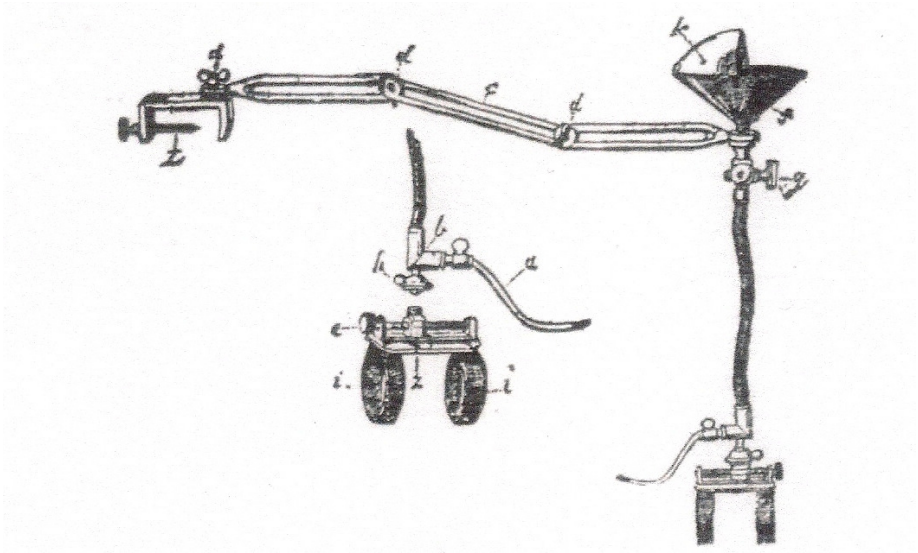

Fig. 6: The Gravitator
i.i. are two pads on a spring-controlled extending arm z which grip the forearm and hold steady the intravenous cannula

Blundell was the foremost obstetrician and gynaecologist of his time and a much respected teacher of physiology. A pioneer in the field of blood transfusion working in the face of considerable hostility and opposition from a section of his professional colleagues, he placed the operation on a sounder and more scientific basis than it had hitherto been, and what was particularly noteworthy, was the first to give warning of the danger of transfusing heterologous blood. There is little if any doubt that he was the first to use human blood for human transfusion. He became an eccentric in later life. It is said he never rose before midday, saw patients at home until 6 o'clock, dined and then set out on his round of visits which usually occupied him until midnight (Wilks and Bettany, 1892).

Contemporary with Blundell were two men who were quick to see the potentialities of this new method of resuscitation in severe blood loss and who

collaborated with him in his work. These were Edward Doubleday, Surgeon to the Royal Infirmary for Children, and Charles Waller, who became Physician-Accoucheur and Lecturer in Midwifery at St. Thomas's Hospital. Of them, Blundell says: "When on the subject of transfusion I should be guilty of criminal injustice were I to forget to mention with applause the names of Doubleday and Waller. Their exertions stand in need of no commemoration from me, but I may be allowed to remark that whatever advantage may be hereafter derived from this operation, to them mankind will be largely indebted for it" (Castle, 1834b).

Doubleday favoured transfusion by syringe and his first case with a successful outcome, one of uterine haemorrhage, was reported in 1825 (Doubleday, 1825). Waller (1860) designed his own apparatus (fig. 7). This was much simpler in construction than either the Impeller or the Gravitator and consisted of a brass syringe, intravenous cannula with connecting tube, and collecting receptacle for the donor's blood. In theory it was possible with this apparatus, which before use was filled with warm water to exclude air, to carry out transfusion more rapidly and so reduce the time the blood remained in contact with the air, but in practice the main complication, which was common to all Blundell's apparatus too, was the tendency for the blood to clot and stop the operation. Like Blundell, Waller used transfusion with extreme caution, reserving it as a last resort in cases of severe haemorrhage. He believed it was seldom necessary to inject more than 4 ounces of blood to successfully revive a patient but thought that up to 12 ounces could be given with safety.

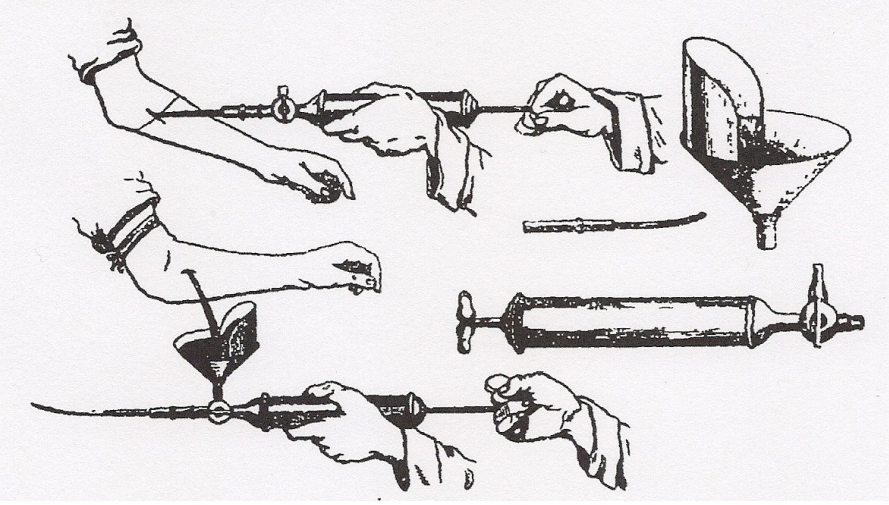

Fig. 7: Waller's transfusion apparatus

Higginson (1871) presented an account of his experiences in thirteen cases of blood transfusion carried out by him in the period since 1848. This was certainly the largest series reported up to that time and, as far as can be ascertained, remained the largest in this country during the remainder of the century. Born in 1808, Higginson studied in Dublin and later went to Liverpool as Demonstrator in Anatomy at the Medical School there. He married Ellen, sister of Harriet Martineau the novelist. He became Consulting Surgeon to the Liverpool Dispensaries and from 1857 to 1867 was surgeon to the Southern Hospital, Liverpool. On his retirement he became Consulting Surgeon to this hospital, a post he held until his death in 1884. He is best remembered as the inventor of the enema syringe which bears his name. Careful search has failed to reveal any published description of this syringe or the date of its invention, but according to Brockbank (1954) the London and Provincial Medical Directory of 1852 describes him for the first time as the inventor of the elastic barrel enema syringe.

Of transfusion, Higginson says: "It appears that the effects of the operation have been such as to place its power and utility beyond question. It remains for future operators and observers to record faithfully their experience, to discriminate the class of cases to which transfusion is applicable, and to improve the operation itself, so as to avoid any imperfections and dangers still attached to it. . . . The blood being a vital fluid and losing its vitality quickly when withdrawn from the circulation there is need . . . that all delay, exposure and interference with it, in its passage to the patient should be avoided. It is also an absolute necessity to provide against the injection of air." The central rubber chamber of the enema syringe, which as originally designed was cylindrical in shape, was incorporated together with its ingenious system of valves in the transfusion apparatus designed and used by him (fig. 8). This consisted of: (1) a metallic cup, A, of six ounces capacity to receive the supply of blood; (2) an outer casing, B, to act as a water bath; (3) an elastic rubber barrel, E, of 1 ounce capacity; (4) a plug, H, to close the aperture, F, when necessary; (5) a rubber tube, G, ending in a metal intravenous cannula, O. Ball valves were provided, at D and F, capable of closing the upper openings when thrown against them, but leaving the lower openings always free. Describing the preparation to be made before transfusion, Higginson said: "Take a wash-hand basin nearly full of hot water, not less than 100°, and immerse in it the instrument and tube. Take out the screw C and fill the cavity B. Fill the tube G through to the opening at K and insert the plug." Ordinarily, when the blood had been collected, the cannula inserted into the recipient's vein, and all made ready for transfusion, the central barrel was squeezed once or twice and then "when the stream was well established the instrument acted by gravitation, requiring no assistance from the hand of the operator."

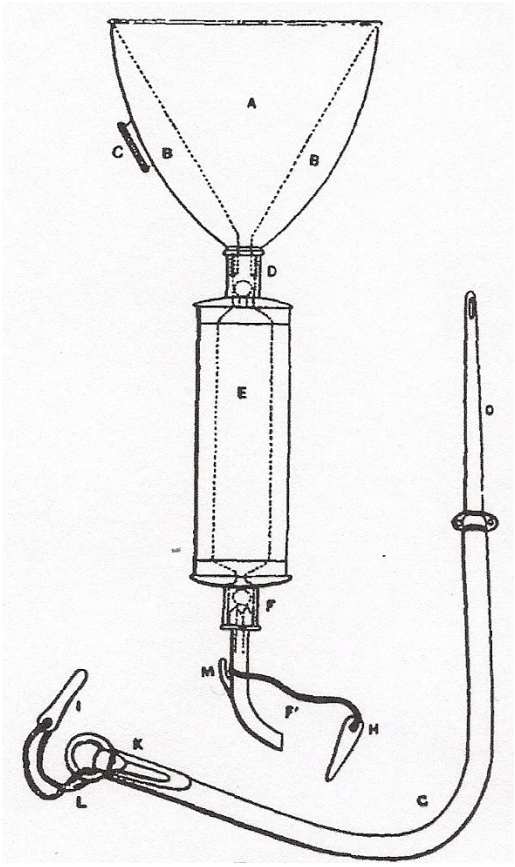

Fig. 8: Higginson's transfusion apparatus

Of the thirteen cases described by Higginson, two occurred in his own practice and the remainder he was called to see in consultation. Ten of these thirteen cases were obstetrical, consisting of four cases of postpartum haemorrhage, three of placenta praevia, one adherent placenta, one abortion and one ectopic gestation, the last more euphemistically called Fallopian Foetation by Higginson. All these cases had suffered severe haemorrhage. Four recovered after transfusion. Of the remainder, one rallied to die a week later from infection, and in another there was a delay of several hours between haemorrhage and transfusion. The amount of blood given varied in these ten cases from 4 to 12 ounces. Since all these cases were almost certainly dying before transfusion, Higginson had good reason to be gratified that he was able to save four of them. Like all who practised blood transfusion at this time, he found coagulation the most troublesome complication and suggested that if this occurred "the operation can be completed with a syringe and teacup".

Although the frequent occurrence of coagulation must have been most irksome and frustrating to these early operators, it must have prevented many tragedies from incompatibility by restricting the use of the operation. It was fortunate, too, that small quantities of blood were considered sufficient for satisfactory resuscitation and that the operation should be reserved for desperate cases only. Reactions did occur. An example can be found among the cases reported by Higginson. Mrs. C, aged 33, transfused for "extreme prostration from the protracted suckling of twins". He says: "The supply of blood was given by a female servant. It was estimated that 12 ounces were injected . . . but in a few minutes the patient was seized with a severe rigor. This was followed by a state of reaction and excitement in which she sang a hymn in a loud voice." Whether many proved fatal is impossible to say since such deaths would have been masked and ascribed to the low state of the patient. Had transfusion been easy and large quantities of blood given indiscriminately, the method would have been rapidly abandoned.

Fig. 9: Aveling’s transfusion apparatus

In an attempt to overcome the hazard of coagulation and to prevent exposure of the donor's blood to air, James Aveling (1865) made a simple apparatus for direct transfusion from donor to recipient's vein (fig. 9). Aveling graduated from Aberdeen University and came south to begin his career as obstetrician and gynaecologist in Sheffield. While in this city he was instrumental in founding the Hospital for Women and became a member of its staff. Moving to London in 1870, he founded, with Barnes and Chambers, the Chelsea Hospital for Women and served upon its staff as Physician (Lancet, 1892). He called his method of transfusion the immediate as

distinct from the mediate method which had up to then been in use. The apparatus consisted of "an india rubber tube to form an anastomosis between emittent and recipient veins with a small bulb in the middle to act as an auxiliary heart". The anastomosis was completed by silver intravenous cannulae. Aveling reported seven cases transfused with this apparatus. One of these was upon a patient whom he had been called to see in consultation in 1872 after she had suffered a very severe postpartum haemorrhage. He found her without a palpable radial pulse and with dilated pupils which failed to react to light. An immediate transfusion was made, using the family coachman as donor, and the patient made a good recovery (fig. 9). Reporting this case, Aveling says: "The coachman, who was not only collected and cheerful, was able to make several useful suggestions during the process of the transfusion." He claimed, quite correctly, that his new apparatus was simple, inexpensive, effective and portable and "capable of being carried in the pocket". He gave as advantages of the immediate method the smaller risk of coagulation and the protection of the blood from air, and concluded: "The operation is safe, easy, uninterrupted and a close imitation of nature." After experience gained in the case described above, Aveling modified his apparatus to include a stopcock at each end to make the propulsion of blood to the recipient more positive (fig. 10).

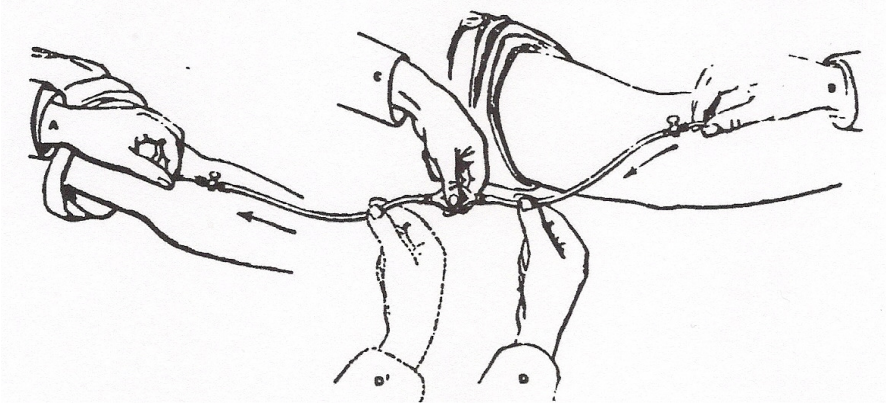

Fig. 10: Aveling's modified apparatus

A contemporary of Aveling's, Graily Hewitt (1865), Assistant Physician-accoucheur at St. Mary's Hospital and later Professor of Midwifery at University College, introduced an apparatus (fig. 11) in which the barrel of the syringe was used as the receptacle for collecting the donor's blood. Of it, he said: "The method allows the almost instantaneous transference of the blood from one individual to another and exposure which, as is well known, tends to produce rapid coagulation, is reduced to a minimum. This is effected by making the syringe itself the vessel into which the blood is received." The syringe with its adjuncts of cannulae, scalpel, etc., were put up in a carrying case and Hewitt advised that it "be carried in the obstetric bag, being thus always at hand in case of emergency."

In an attempt to prevent coagulation of blood during transfusion Braxton Hicks (1869), Obstetric Physician and Lecturer in Obstetrics at Guy's Hospital, described the use of an anticoagulant. Seeking for a suitable substance to add to the donor's blood, he was advised by Dr. Pavy, Assistant Physician to Guy's Hospital, that phosphate of soda "would be the best tolerated". After satisfying himself by animal experiment that blood so treated appeared safe, Hicks used the method to treat four obstetrical patients. Unfortunately all four cases died, but reading the case histories of these unfortunate women it is too plainly obvious that they were already moribund and beyond aid when transfusion was commenced. Indeed, the indications for transfusion given by Hicks show how low the patient was allowed to sink before recourse was made to the operation for he says: "Perhaps the symptoms on which I

should rely most are the obstinate jactitation and resistance to comply with our wishes in regard to treatment coupled with the persistent indistinctness of the pulse." His solution was prepared by dissolving 3 ounces of phosphate of soda in 1 pint of water. The solution, which crystallized out at room temperature, was warmed to 100°F before use and added to the blood in the proportion of 1:4.

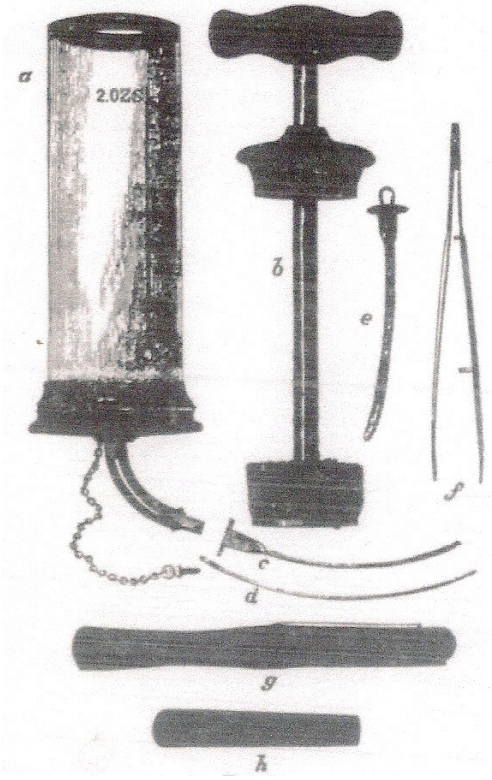

Fig. 11: Hewitt's transfusion apparatus

This new technique, which simplified transfusion considerably, appears to have been widely adopted. It was introduced to Edinburgh by J. M. Cotterill (1884), Assistant Surgeon to the Royal Infirmary. After describing its use with complete success, first in a severe haematemesis and later in a blast injury which required four transfusions, he said of it: "There can be little doubt that the operation of transfusion is one which in the future is destined, in our Edinburgh School, at least, to hold a far more prominent position than it has hitherto done. This is due to the fact that the method of operation has been simplified and perfected: the applicability of the operation to various classes of cases increasing in the same proportion as the recognition of the ease and safety with which it can be performed. It is somewhat remarkable that this method has not come into more general use, as it certainly deprives the operation, as usually performed, of most of its difficulties and dangers."

Another member of the surgical staff of the Edinburgh Royal Infirmary, John Duncan (1886), also used this method. In dealing surgically with injuries, particularly those requiring amputation, it was his practice to collect the blood shed from the wound during operation in a bowl containing Hicks's saline solution. At the end of the operation, when all bleeding points had been ligated, this blood was re-injected into a vein. Duncan advocated this method since it removed the need to find a donor, often at short notice. He was unaware that he was removing the danger of incompatibility.

To overcome the difficulty and danger of coagulation some advocated the use of defibrinated blood. The method entailed whipping the blood with a wire whisk or glass rod after collection in a suitable vessel and later straining through a horse-hair sieve to remove small pieces of fibrin which had not adhered to the whisk. It was

time-consuming and this was a particular disadvantage in an operation which was usually one of very extreme urgency. Among those who used the method was Robert McDonnell (1870), Surgeon to Dr. Steevens' Hospital, Dublin. He claimed that once the fear of coagulation was removed the need for haste and the risk of embolism vanished. He was satisfied that all the important elements, "the serum, salts, blood discs and vivifying agents" were preserved and further that "nothing was left out save what is physically useless if not injurious and surgically dangerous". He acknowledged that the time lost in defibrination was quite unjustifiable in cases requiring urgent transfusion and suggested the use of Hicks's anticoagulant solution in such cases. He designed a simple form of apparatus (fig. 12). This consisted of a glass pipette, ABC, of such size that the bulb, C, was capable of holding 6 ounces of blood; a length of rubber tubing, D, with a glass insert, F, to detect the passage of air bubbles, and a silver intravenous cannula. McDonnell noted that the weight of the column of blood was usually sufficient to carry it into the recipient's vein but added that if the flow was sluggish "the mouth could be applied to the end, A".

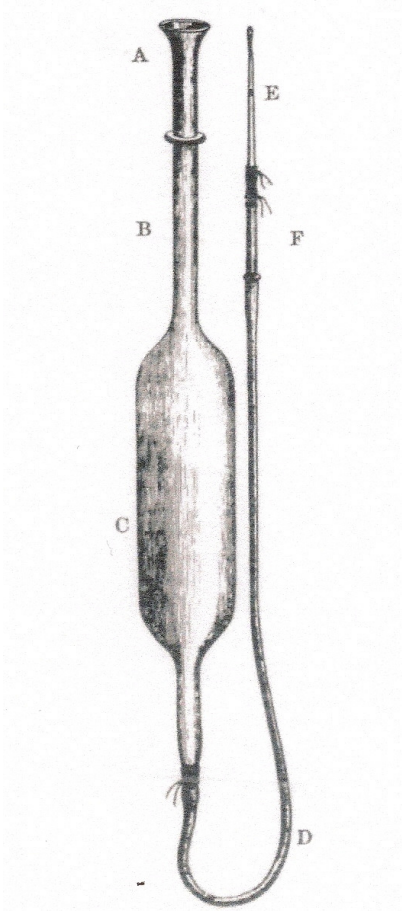

Fig. 12: McDonnell's apparatus

W. S. Playfair, Professor of Obstetric Medicine in King's College, also advocated defibrination of the blood. Reporting the use of transfusion in a case of postpartum haemorrhage (1872) he says: "In considering the lessons to be learnt from this case, the most important seems to me to be the further evidence is gives of the importance of defibrinating the blood before commencing the operation. The process by which this is effected is extremely simple and the fact of not being hurried . . . is of immense importance in an operation every step of which should be conducted leisurely and calmly. It is certain that the removal of the fibrin does not in any way deteriorate the blood for the purposes of transfusion." William Walter (1885), Surgeon to St. Mary's

Hospital for Women and Children and the Manchester and Salford Lying-in-Hospital, produced a modification of McDonnell's apparatus (fig. 13). He described it as consisting of "a glass tube sufficiently large to hold four ounces of blood. One end of the apparatus was drawn to a point for the purpose of connecting it to a piece of india-rubber tube, which in form resembled a very small Higginson's syringe." The blood sometimes flowed by gravity into the recipient's vein but if it failed to do so it was necessary to force the blood into the vein by squeezing the dilatation in the tube.

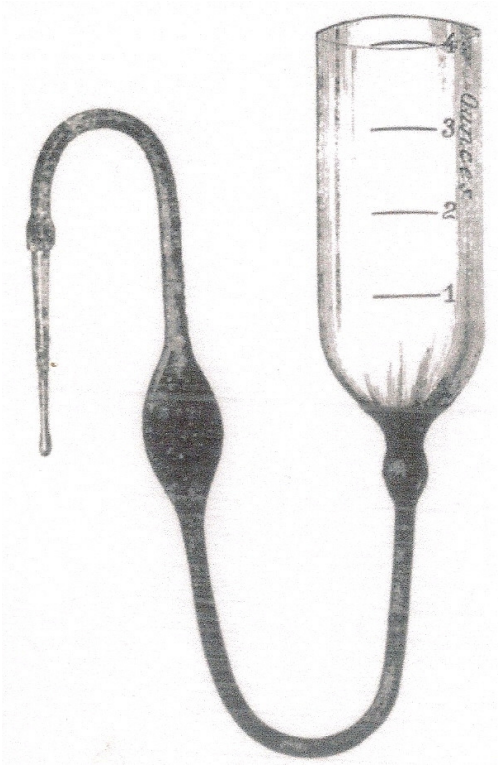

Fig. 13: Walter's transfusion apparatus

The several methods of transfusion available, together with the variety of forms of apparatus for performing the operation may well have been responsible for the decision of the Obstetrical Society of London (1872) to set up a committee to investigate the subject. John Hall Davis, Obstetrical Physician to Middlesex Hospital was elected chairman and Henry Madge the honorary secretary. The committee appears of have remained in being until 1878, but although a very careful search of the Proceedings of the Obstetrical Society and of the contemporary journals has been made, no report can be found. Apart from the announcement of its formation, the only reference to its deliberations was made by Madge (1874), when he reported upon the scope of the committee's work and appealed to those with experience of transfusion to submit their findings. This committee must have accumulated a wealth of information concerning both the current views of the operation and the types of apparatus available. It is regrettable that its findings, which would have been of the greatest historical interest, were apparently never published.

Transfusion had commenced in the days when the meaning of asepsis was quite unknown and the impact of Lister's teaching is to be seen in the report of a case by William Macewen (1879), Surgeon to Glasgow Royal Infirmary, entitled "The Antiseptic Transfusion of Human Blood in a patient the Subject of Secondary Haemorrhage: Cure". The arms of both donor and recipient and the carbolized collecting vessel were kept constantly under the carbolic spray and the blood was drawn into a carbolized syringe for transfusion. As the century drew to its end the

profession's views on transfusion changed radically. The transfusion of simple saline fluid, first described as early as 1848 by Spencer Wells, was being used more and more as a method of resuscitation in blood loss and shock. It was believed to be as efficacious as blood; it was certainly easier to use and when viewed against the background of more frequent fatalities consequent upon the more widespread use of blood transfusion, it seemed so much safer. The current views were probably expressed by William Hunter (1889) in the Arris and Gale Lectures at the Royal College of Surgeons of England, who said: "The question as to the value of transfusion seems ever to remain an open one . . . the present attitude of medical opinion may be described as one of healthy scepticism." He discussed the physiological and pathological problems presented by blood transfusion, noting that it was necessary to find an explanation for the disturbances such as dyspnoea, tachycardia, syncope, etc., frequently encountered. Mentioning the use of sodium phosphate, he emphasized the opinion that many of the symptoms, now known to be due to incompatibility, were caused by the addition of this salt. He summed up his lecture by saying: "If there is a threatened failure of the circulation as a result of sudden loss of blood, then it is unnecessary to have recourse to blood transfusion as infusion of any neutral saline meets equally well if not better all the indications. . . . In an emergency the infusion of ordinary water has been followed by results as successful as any ever obtained by transfusion of blood. . . . Transfusion of blood will continue to be practised . . . for practical purposes, however, all the advantages to be gained by it may, I believe, be equally well and more readily obtained by infusion of neutral salt, such as 3/4 per cent common salt." So the nineteenth century was destined to end as it had begun, with blood transfusion in eclipse, but fortunately for mankind it was an eclipse of short duration. It is interesting to speculate on the part, if any, men like Blundell, Doubleday, Waller, Higginson, Aveling, Hicks, McDonnell, and the many others who practised blood transfusion, played in bringing to fruition the operation as we know it today. That they were instrumental in saving the lives of some few patients cannot be denied, but viewed in retrospect their achievements appear to bear little relation to the present-day practice of blood transfusion. Yet, however small, it is pleasant to believe that their exertions were but part of the eternal pattern; part of the tide of progress. In the words of Arthur Hugh Clough:

"For while the tired waves, vainly breaking,
Seem here no painful inch to gain,
Far back, through creeks and inlets making,
Comes silent, flooding in, the main."

REFERENCES

Aveling, J. (1865). On immediate transfusion. *Trans. obstet. Soc. Lond.*, 6, 126.

Blundell, J. (1818). Experiments on the transfusion of blood by the syringe. *Med.-chir. Trans*, 9, 56.

Blundell (1824). Researches Physiological and Pathological, p. 63. London: E. Cox & Son.

Blundell (1828-9). Observations on transfusion of blood. *Lancet*. 2. 321.

Braybrooke, R. (1906). *Diary and Correspondence of Samuel Pepys, F.R.S.*, 3rd ed. (reprint); vol. 2. pp. 443, 445; vol. 3, pp. 294, 300. London: Swan Sonnenschein.

British Medical Journal (1878). Blundell, J.: obituary notice, 1, 351.

Brockbank, W. (1954). *Ancient Therapeutic Arts*, p. 59. London: Heinemann.

Castle, T. (1834a). *The Principles and Practice of Obstetricy as at Present Taught by James Blundell, M.D.*, p. 427. London: Cox.

Castle, T. (1834b). *idem.*, p. 429.

Cotterill, J. M. (1886). Severe injury from dynamite. Transfusion of blood four times; recovery. *Brit, med. J.*. 2, 630.

Doubleday, E. (1825). Case of uterine haemorrhage successfully treated by the operation of transfusion. *Lond. med. phys. J.*, 54, 380.
Duncan, J. (1886). On re-infusion of blood in primary and other amputations. *Brit. med. J.*, 1, 192.
Gunther, R. T. (1932). *Early Science in Oxford. 9. De Corde by Richard Lower, 1669*. Trans, by K. J. Franklin. Oxford: The Author.
Hewitt, G. (1865). Apparatus for the performance of transfusion. *Trans, obstet. Soc. Lond.*, 6. 136.
Hicks, J. B. (1869). Cases of transfusion. *Guy's Hosp. Rep., Ser.*, 3, 14, 1.
Higginson, A. (1871). Tabular report of thirteen cases of blood transfusion; with a diagram of the operator's instrument. *Liverp. med. surg. Rep.*, 5, 104.
Hunter, W. (1889). Transfusion; its physiology, pathology and practice. *Brit. med. J.*, 2, 116; 237; 305.
Jones, H. W., and Mackmull, G. (1928). The influence of James Blundell on the development of blood transfusion. *Ann. med. Hist.*, 10, 242.
Lancet (1892). James Aveling: obituary notice. 2. 1477.
Leacock, J. H. (1817). On the transfusion of blood in extreme cases of haemorrhage. *Med.-chir. J. & Rev.*, 3, 276.
McDonnell, R. (1870). Remarks on the operation of transfusion and the apparatus for its performance. *Dubl. Quart. J. med. Sci.*, 50. 257.
Macewen, W. (1879). Antiseptic transfusion of human blood in a patient the subject of secondary haemorrhage; cure. *Lancet*, 2, 4.
Madge, H. M. (1874). On transfusion of blood. *Brit, med. J.*, 1, 42.
Obstetrical Society of London (1872). *Trans. Obstet. Soc. Lond.*, 14 (1873), 103.
Playfair, W. S. (1872). Notes of a case of fatal postpartum haemorrhage in which transfusion of blood was practised. *Lancet*, 1, 108.
Soden, J. (1852). A case of haemorrhage from inversion of the uterus in which the operation of transfusion was successfully performed with remarks on the employment of transfusion generally. *Med.-chir. Trans.*, 31, 413.
Thoms, H. (1931). John Sterns and pulvis parturiens. *Amer. J. Obstet. Gynec*, 22. 418.
Waller, C. (1825). Blood transfusion: successful case. *Lond. med. phys. J.,* 54. 273.
Waller, C. (1860) On transfusion of blood. *Trans, obstet. Soc. Lond.*, 1, 61.
Walter, W. (1885). Portable transfusion apparatus. *Trans, obstet. Soc. Lond.*, 26. 182.
Wilks, S., and Bettany, G. T. (1892). *A Biographical History of Guy's Hospital*, p. 365. London: Ward, Lock, Bowden & Co.