

## Brief Report

# Early History of Blood Substitutes Transfusion of Milk

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**In the final quarter of the 19th century, dissatisfaction with blood transfusion prompted a brief wave of enthusiasm for transfusion of milk as a blood substitute. Although transfusion of cow's milk was first attempted in Canada in 1854, this form of treatment achieved its greatest popularity in the United States between 1873 and 1880. During this interval, transfusion of milk from cows, goats and humans was attempted. However, adverse effects, as well as the advent of isotonic saline solutions, prompted its discontinuance.**

ALTHOUGH transfusion of blood has been advocated since ancient times, not until the present century has it been placed on a rational scientific basis, with relative safety for both donor and recipient. The procedure received its initial impetus in the 17th century with the pioneering experiments of Lower, in England, and Denys, in France, who infused animal blood into humans with variable results. However, adverse reactions from these trials resulted in the decree of Chatelet, in 1668, which led to virtual discontinuance of blood transfusion for the subsequent 150 years.

James Blundell re-introduced the procedure in the early 19th century, and was the first to advocate use of human blood for transfusion purposes. During the following 50 years the procedure was widely practiced in Europe, and to a lesser extent in America. However, its indiscriminate use resulted in many untoward reactions in recipients. Moreover, there was the seemingly

insurmountable problem of prevention of coagulation. Once again transfusionists resorted to animal blood for transfusion of humans. However, as the number of unfavorable results mounted, blood transfusion again fell into disrepute and rarely was attempted in the final years of the 19th century.<sup>15</sup>

It was at this time that a brief, yet fascinating, chapter in the history of transfusion was recorded. Frustrated and discouraged with blood as a transfusion product, effective substitutes were sought, and for a short time, milk seemed to be the panacea. Whereas transfusion of blood in the 19th century was most actively practiced in Europe, especially in England, transfusion of milk achieved its greatest popularity in North America.

Intravenous injection of milk into humans was first practiced by Drs. James Bovell and Edwin Hodder in Toronto, Canada, during the cholera epidemic of July, 1854.<sup>1</sup> Their rationale for such treatment stemmed from the experiments of Donn , who had injected milk into a variety of animal species and concluded that the "minute oily and fatty particles found in milk . . . were convertible into the white corpuscles of the blood." Furthermore, he believed that the white corpuscles were red blood corpuscles in process of transformation.<sup>6</sup>

Bovell and Hodder's first patient, a 40-year-old man, was said to respond dra-

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matically to injection of 12 ounces of cow's milk. The cow had been brought to the hospital and milked through gauze into a bowl kept at 100 F by immersion in warm water. They repeated the procedure on a second patient three days later with equally good results. However, two other patients whom they transfused the following week died. Bovell also notes that three patients were transfused with milk by one of his pupils, Mr. John MacKenzie; however, all three died shortly afterward.<sup>1</sup>

In 1873 Dr. Hodder, who became one of the most respected physicians in Canada, recalled the events of 1854.<sup>8</sup> His account differs from that of Bovell; he mentions only three patients who were transfused with milk, and indicates that larger volumes were administered. Hodder concluded this report somewhat ruefully, "Dr. Bovell and myself then applied to the corporation (of the city of Toronto) for a good cow, and a few articles indispensable for the comfort and well-being of the patient; these were refused, and we thereupon sent in our resignation."

Milk transfusion was not performed again until 1873, when Dr. Joseph Howe, of New York City, employed it for a patient with generalized tuberculosis.<sup>9</sup> Unlike Hodder and Bovell, Howe used goat's milk for the procedure. His patient experienced vertigo and nystagmus followed by chest pain after intravenous injection of 1.5 ounces of the milk. Later the same day the patient manifested similar symptoms after receiving three more ounces of the goat's milk, which had been retained at room temperature. Howe observed that "notwithstanding the fact that the patient thought himself benefited, I am of the opinion it had no effect." The patient died on the following day. Shortly thereafter Howe repeated the procedure on a second patient, terminally ill with tuberculosis. This patient not only manifested nystagmus and chest pain during the transfusion, but also complained of

intense lumbar pain and dyspnea. The symptoms disappeared at the conclusion of the procedure, but the patient became comatose and died four hours later.

In a departure from accepted modern practice, Howe undertook a series of animal experiments only after he had obtained equivocal results in humans.<sup>10</sup> He bled seven dogs to a state of syncope and attempted to revive them with milk transfusion; all of the animals died. Two other dogs, similarly bled to a syncopal state, were not transfused and recovered. Howe's conclusion was inescapable: "the milk killed the dogs." However, he was not completely discouraged, for he surmised that it was the excessive volume of milk given to the dogs, rather than the milk itself, that killed them.

Howe's third recorded clinical trial of milk transfusion was before an audience in Charity Hospital, in New York City, in 1878.<sup>10</sup> The patient was a woman with advanced pulmonary tuberculosis who "has not strength enough to speak above a whisper," although Howe acknowledged "that some of this condition is due to fright." A goat was brought into the room, milked through carbolized gauze, and four ounces were given to the patient. Although spasmodic respirations were evident during the procedure, she seemed to be improved at its conclusion.

The most outspoken advocate of milk transfusion in this country was Dr. T. G. Thomas, of New York City. In 1875 he first transfused cow's milk into a woman who had had severe uterine hemorrhage.<sup>18</sup> After six ounces of milk had been administered the patient "complained that her head felt like bursting." Subsequently she developed tachycardia and a high fever. However, she experienced progressive improvement during the succeeding week.

During the next three years Thomas performed milk transfusion on seven patients.<sup>19</sup> He discouraged use of blood transfusion because of "the inherent difficulties and

dangers of the operation, almost all of which arise from the tendency to coagulation." Moreover, his rationale for milk transfusion was analogous to that of Bovell and Hodder: "while chemically inferior to blood, milk is more allied to chyle, the material of which nature makes blood, than any other fluid." He predicted a "brilliant and useful future for intravenous lacteal injection."

Side effects of milk transfusion, similar to those experienced by Thomas's patient, were observed by Dr. William Pepper.<sup>16</sup> He transfused two patients with cow's milk; both complained of intense headache, fever, and tachycardia, and both manifested albuminuria. Yet he remained optimistic as to the future of this procedure.

Dr. J. S. Prout, of New York, supported Thomas's admonition that no more than eight ounces of milk should be injected at one time.<sup>17</sup> He noted the observations of Dr. Wulfsberg, of Göttingen, Germany, who found that injection of large quantities of milk into animals invariably led to the formation of pulmonary emboli. Prout postulated a medical-legal use for milk transfusion, in that it might prolong life for a sufficient time to permit "the victim of an assault to identify his assailant." In this regard he alluded to George Eliot's story, *The Lifted Veil*, in which "a wicked lady's guilt was brought to light by transfusing blood into the heart of a person just dead, who revives for an instant and denounces her."

The most active transfusionist in Europe at this time was Meldon,<sup>13</sup> in England. By 1880 he had performed 20 such transfusions, using goat's milk. He believed it to be far superior to injection of blood, but noted the necessity to render the milk alkaline by addition of ammonium carbonate.

Hamlin,<sup>5</sup> in Maine, Brinton,<sup>2</sup> in New York, and Bryson,<sup>3</sup> in St. Louis, among others, also advocated use of milk as a substitute for blood in the eighth decade

of the 19th century. According to Brinton, milk possessed two distinct advantages over blood; there was no danger of its coagulation, and no danger of air embolism. At the conclusion of his 1878 discussion, Brinton predicted, "I think that this procedure will, in a few years, entirely supersede the transfusion of blood."

However, such was not the case. Reports of severe side effects from milk transfusion were not balanced by evidence of its beneficial results. Moutard-Martin and Richet,<sup>14</sup> in 1879, warned that patients could be killed by milk transfusions, as a result of "bulbar anemia," and concluded that "its injection is a useless and dangerous operation and one which should be absolutely proscribed." In the same year Helmuth, in the United States, concluded that milk transfusion was much more dangerous than blood transfusion.<sup>7</sup> The following year Howe,<sup>11</sup> who had re-introduced the procedure seven years earlier, regarded it to be a dangerous operation, "one which in no way possesses the value of blood transfusion."

Nevertheless, in 1880, Howe attempted one final experiment.<sup>11</sup> He sought to determine whether human milk might prove superior to the milk of the cow or goat for transfusion purposes. He attempted the infusion of three ounces of milk obtained from a healthy postpartum woman. The patient, a woman with suppurative lung disease, complained of pain in her chest and back shortly after the injection began, and stopped breathing after two ounces had been given; however, she was resuscitated by artificial respiration and by "injections of morphine and whiskey." Howe concluded that human milk was no more suitable for transfusion than goat or cow milk.

Thereafter, enthusiasm for milk transfusion quickly waned. In 1880 Meldon observed that the procedure had received little support in Europe, and had fallen into disrepute in New York.<sup>12</sup> Final abandonment of milk transfusion came with the

advent of isotonic saline solutions for intravenous use. By 1884 Bull<sup>4</sup> was able to find only 19 previous reports of saline infusion; however, these solutions rapidly achieved tremendous popularity. Meanwhile, blood transfusion lay dormant, awaiting the momentous discoveries of the 20th century.

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