

a scald. The shocks in these cases were moderate, and its stages were sufficiently slow that the order of sensations could be observed. I have not been able to get much information in cases of severe shock, farther than that there was a terrible feeling which was not pain.

Assuming these observations to be correct, we will now sum up the symptoms of shock, subjective and objective, and endeavor by the light of physiological research to explain their significance. Experiment upon animals has proved that the first effect of excitation of the cerebro-spinal system is contraction of the vascular system of the body, increasing the tension of the vessels, accelerating the blood flow and slowing of the heart's action. 2nd. A stage of paralysis of the vaso-motor system with dilatation of the vessels, diminished tension, stagnation of the blood and frequent ineffectual heart's action.

Violent irritation stops the circulation, 1st, by excessive contraction of the vessels, and 2nd, by the complete paralysis that follows, the capillaries being dilated to such an extent as to contain all the blood, so that none reaches the heart and large veins which are found to be empty. This is observed in a frog killed by a sharp tap on the abdomen: all the blood is contained in the capillaries of the intestines, and thus it is removed from the circulation as effectually as if the animal had been bled. This is what happens in extreme shock, which is immediately fatal.

Continued and repeated irritation causes alternate contraction of the vessels, and finally exhausts the nerves and produces the condition of extreme shock. The frequency and debility of the heart's action in this stage of exhaustion is not due to direct depression of the organ itself, but to want of blood to fill it, since it immediately resumes its wonted vigor if it is artificially filled with blood or a saline solution.

Irritation of a sensory nerve excites, 1st, its own centre, and the reflexion is upon the vessels in immediate connection with it. A stronger irritation extends to other centres in physiological relation with the first and the vessels in reflex relation with them. A still stronger irritation extends over all the nerve centres, but affects most those immediately irritated by it, thus, while the later symptoms of shock may vary, the several stages of this condition are the same.

In the application of these principles to the symptoms of shock we observe, 1st, the "thud," the "pressing feeling," the "numbness in the bones," all mean the same thing, viz.: shock or sudden excitation of the cerebro-spinal system and primary contraction of the vascular system. The next sensation unanimously expressed was that of warmth and excited action of the heart. This is probably the stage of commencing a moderate dilatation of the vessels, when the tone is moderate, the heart full and vigorous, and the circulation consequently good. This stage is short, and precedes complete dilatation, followed by perspiration and symptoms due to deficient supply of blood to the nerve centres, such as general debility, nausea, blindness, tinnitus aurium, syncope, convulsions, &c.; again, pallor and coldness of the surface, and suppressed secretion of the kidneys take place from accumulation of blood, as a passive congestion, in the abdominal organs, which contain a large amount of this fluid on account of their extensive capillary system. A rapid small fluttering pulse and thirst are due to an empty state of the heart and great vessels. There are other symptoms of shock the causes of which are not so evident. Among these, I will mention moderate dilatation of the pupils; an upward tendency of the eyes, tympanites, imperfect breathing, sighing, and a constant desire to be raised up, and, in some severe shocks, a violent pain in the stomach, which is often the unfortunate man's only and great distress. This symptom appeared to me to occur in those who were injured shortly after a meal. In a hopeless case I once injected hypodermically two or three grains of morphia in an hour without any sensible effect.

Vomiting and chills are reactionary symptoms, the former by forcing the blood from the abdomen to the heart, and the latter by dilating the vessels leading to other parts of the body, and thus assisting the abdominal vessels to resume their tone by relieving the pressure upon their walls.

Beside the direct shock to the nervous system and the secondary effect upon the circulation, there is another consideration worthy of notice: We are aware of the influence of the nerves upon the nutritive processes of the body, the secretions and the blood. Instances of the immediate changes produced upon the mother's