

ations in functional activity in both health and disease. Changes have been demonstrated to take place in the ganglion cells of fatigued animals and of those subjected to various infectious and toxic processes. Such changes, if long continued or of sufficient intensity, may give rise to permanent structural alterations, such as have also been found after infections and intoxications in both lower animals and men. In this way chronic degenerations arise and death results.

A quotation from a paper¹ read some years ago seems not inappropriate at this point:

Every cell inherits from its parent cell a certain lease of life, at the end of which physiologic death occurs. This period, however, may be influenced by external conditions. Premature death is pathologic. We can not recognize a pathologic longevity. Similar laws apply to the human individual, the composite of a vast aggregation of cells of widely differentiated function. The life of man may be divided into three periods: that of evolution, of growth, of development; that of maturity, of perfection; and that of involution, of decline. The first begins with birth, the last ends with death.

During the period of growth and development, tissue-change and destruction—catabolism—are more than offset by tissue construction and repair—*anabolism*. Nutrition exceeds waste. Building up is more active than tearing down. With the activity of life comes the demand for the highest differentiation of function of which the organism is capable. This represents the perfect individual. For a time, a condition of equilibrium is maintained. Sooner or later, however, the tide begins to turn. The equilibrium is disturbed. Waste exceeds repair. The cellular assimilative function becomes impaired, the constitution of the nutritive fluids defective. Tissues and organs are imperfectly furnished with the materials for their maintenance. Vascular changes occur. In a vicious circle, one baneful influence reacts upon another. The entire organism is reduced to a condition of deterioration. Finally, the state of nutrition falls to so low a level as to be insufficient for the purposes of life, and functional activity comes to a standstill. This is the physiologic process, as it occurs at advanced age, and constitutes the condition of senility. Occurring at an earlier period, however, the process becomes pathologic, recognized clinically by signs and symptoms which may be conveniently included in the designation "premature senility."

As the component parts of the organism depend for their sustenance upon the nutritive elements of the blood, so will their functional stability be governed by the quality and quantity of the circulating medium. Thus, we would be led to look to the blood as containing the excitant which induces the earliest changes. The function of the cell once impaired, the deleterious action of the blood would be augmented by the retention of matters which it was the part of the cell to remove, and the addition of products from the degeneration of the cell.

Other aspects of the results of derangement of metabolic equilibrium have been dwelt upon recently by Riesman², who refers to the products generated in consequence of certain neoplastic and hyperplastic processes and the symptoms resulting therefrom. For this condition he proposes the appropriate designation "metabolic toxemia." So-called internal secretions and their derangements are to be considered in the same connection.

A most valuable contribution to this subject, from the chemist's point of view, has been made by Chittenden since this paper was written, in a communication on "Auto-intoxication," presented to the Pathological Society of Philadelphia on April 27, 1899.

¹ A. A. Eshner: Arterio-capillary Fibrosis. Transactions of the Philadelphia County Medical Society, 1891.

² Internal Secretions; Metabolic Toxemia. Phil. Med. Jour., Feb. 4, 1899, p. 270.

Dr. W. W. ASHTON, Alexandria, La., has been appointed by the State board of health as resident inspector at New Orleans.

SUBCUTANEOUS RUPTURE OF LARGE ARTERIES FROM CONTUSED WOUNDS.*

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In the treatment of this subject I shall not discuss injuries to the arteries as they usually occur, complicated with grave lacerations of the skin and soft parts, but will limit the scope of this paper to those cases where the force of the injury is so directed against the artery as to rupture its walls, while the skin and soft parts remain practically intact.

As an introduction to the subject, I present the following case: James W., colored, age 23 years, brakeman, while coupling cars at Grand Junction, Tenn., 1 A.M., May 21, 1898, had his right arm caught between the bumpers, the soft parts contused below and above the elbow, the neck of the radius fractured, the vessels ruptured, the skin remaining intact with the exception of slight abrasions of the cuticle in a few places. He was at once attended by a physician, who stated that he would be disabled for some three or four weeks. He arrived in Jackson about 4 A.M., when Dr. J. L. Crook called to see him and dressed the swollen arm in hot antiseptic dressings.

About 10 A.M. we found him suffering greatly, the arm and hand being cold and enormously swollen. There was complete absence of the radial pulse, nor could any pulsation be detected in the ulnar artery. We diagnosed the case as rupture of the brachial artery with great injury to the subcutaneous tissues and probable fracture of the neck of the radius. On account of the enormous distension of the arm, caused by effusion of blood in the intercellular tissue, we could not make a positive diagnosis of the fracture.

To relieve the great swelling and tension I made several punctures into the tissues with a keen narrow bistoury at various points along the under side of elbow and arm and on the back of the hand, which allowed the effused blood to flow out freely until the tension and pain were relieved. The arm was then bathed in hot bichlorid water, wrapped in layers of cotton wrung out of hot bichlorid solution, dry lint applied over this, and bandaged with sufficient support to restrain hemorrhage. The patient expressed himself as being greatly relieved and said that his arm was very comfortable.

I stated to him that it was highly probable he would lose his arm, that the arteries were ruptured and the soft parts and capillaries so badly injured that it was hardly to be expected that sufficient circulation would be carried on to save its life. His reply was that he would never consent to having his arm "cut off," "that he could work his fingers and had some feeling in them."

The next day there was some improvement in the arm, there was feeble capillary circulation down to the metacarpo-phalangeal joints, but no circulation in the large vessels. I continued the same line of treatment, and the condition of the arm remained about the same, only showing a little more sign of returning life, for several days; some blisters, however, appeared near the wrist and along the forearm, but the thumb and all the fingers began to shrivel and assume the condition of dry gangrene back to near the metacarpo-phalangeal articulation. The patient was free from fever, comfortable, with a good appe-

* Read before the Tennessee Medical Society, Nashville, April 11, 1899.

tite, and quite cheerful. We had strong hopes of saving all but the fingers. It seemed that the hot bichlorid packs had exerted a salutary effect, the condition of the arm remaining almost stationary for two weeks, the few blisters mentioned being the only sign of developing mortification except at the finger tips.

But on visiting him June 15, sixteen days after the injury, we saw that our efforts to save the limb had failed, that the forces of life were withdrawing to a point including a portion of the elbow-joint, and the hand and arm were in a condition of gangrene. On the morning of June 20, twenty-one days after the injury, the line of demarcation being plain, the patient was removed to the Presbyterian Hospital and I amputated the arm above the elbow at the junction of the middle and lower thirds. The patient made a rapid and uneventful recovery.

In reviewing the literature at my disposal I was astonished to find that so little had been written on the subject of rupture of large arteries. Neither Gross nor Wyeth mention such injuries, and the "American Text-book of Surgery" devotes only a few lines to its consideration. In this age, owing to the vast multiplication of railroads and other means of rapid transit, such injuries are likely to be of frequent occurrence. Hence they must prove an interesting type of traumatism, fraught as they are with such grave consequences to the limbs and lives of the victims, and with such great responsibilities to the surgeon.

In the *Railway Surgeon*, May 31, 1898, and subsequent issues to July 26, 1898, there appeared a translation of a continued article by Felix Lejars, in which he reports a case almost identical with this case, caused by two wheels of a loaded cart passing over the right arm and producing attrition of the right brachial artery. In this case a dry gangrene developed in the thumb and fingers, almost exactly as first appeared in the case I have reported. But as the soft parts were not so badly damaged, Dr. Lejars was enabled to save the arm, with loss of thumb and fingers. The radial pulse appeared, though feeble, four months after he had amputated the fingers. Above the elbow, a vertical cord could be felt strewn with nodules that seemed to be the obliterated artery (vide out of this case, *Railway Surgeon*, May 31, 1898, p. 8). Dr. Lejars collected thirty-four cases, only four of which involved the brachial artery, besides his own—those of Cusco, Moré, Hulke and Lawson. About one-third of these cases involved the popliteal and one-third the femoral arteries, showing such accidents to occur most frequently in the lower limbs. Such injuries are caused by severe contusions, such as being caught between the bumpers, as in my case, or from severe pressure, as the passage of a wagon-wheel, in Dr. Lejars' case. Under such circumstances, it can readily be perceived that an artery filled with blood may have its friable coats ruptured without any laceration of the skin or soft parts. These lesions may be of different degrees of gravity, as a total rupture, rupture of the middle and inner tunics, or of the inner tunic alone. It is important to remember that while in some of these lesions the subjacent circulation is obliterated from the first, others manifest themselves by a slow coagulation which may require several days to complete.

The clinical picture presented in cases of immediate obliteration will materially differ from that seen

in those where obliteration is retarded. In the first instance, the symptoms are well marked. If the traumatism has been severe there will frequently be considerable shock—general and local. Absence of the pulse in the region below the site of rupture is an important sign, and was plainly manifested in my case. It is well here to emphasize the importance of search for the pulse in all severe contusions of the limbs to ascertain if the circulation is impeded. Coldness of the limb is always present and its temperature is appreciably lower than that of the sound one. There will also be a diminution of sensibility, though the zone of cutaneous anesthesia does not always correspond with the cold areas. These symptoms, associated with swelling, distension and pain incident to the pressure from effused blood, can hardly be mistaken by a careful observer.

The diagnosis is not so clear when the signs of obliteration are tardy in appearing. In a case reported by Hulke, he states that "there was no sign of arterial lesion until the third day, when the forearm and arm were swollen and strewn with red and green spots nearly to the shoulder." Verneuil corroborates this testimony in reporting a case, saying: "A man received a contusion of the groin; at first the circulation in the leg kept up and the phenomena of obliteration did not appear until twenty-four hours after."

But whether the obliteration be rapid or slow, the injury is grave and generally followed by gangrene of greater or less severity. However, it occasionally happens that healing occurs after arterial attrition, leaving no other effect than a slight weakness of the limb.

It is hardly necessary to say that we should exercise great caution in giving a prognosis in these cases. The reasons for this are obvious. If the middle and inner tunics only are involved, it may be followed by a large aneurysm, or secondary hemorrhage from sloughing of the other coat.

The treatment should be conservative, every effort being made to restore life to the limb and prevent gangrene, which is so imminent. To this end, the entire limb should be thoroughly cleansed and rendered aseptic by antiseptic solutions, attention being given to every abrasion in the cuticle lest it be the point of entrance for infection. This treatment should then be followed by enveloping the limb in hot antiseptic packs, wet and dry, over which thick layers of dry cotton are applied, supported gently by a bandage. If indicated, as in my case, I should not hesitate to make punctures into the cellular tissues to relieve the tension and allow the effused blood to escape. It may sometimes be beneficial, if the case is seen early, to open up the limb, evacuate the effused blood and ligate the ruptured vessel. After the artery is secured, if there is much shock, the saline infusion would certainly be indicated. Later on in the case the treatment will depend on the condition of the limb, and the character of the gangrene. If it be dry and localized, we should wait for nature to complete the line of separation. If moist and rapid, amputation high enough to include only sound tissue in the flaps is the only resource.

THE HEALTH officers of San Francisco have ordered a detention of the transports at that place for a period of sixteen days, owing to the development of small-pox among the passengers. The transports were bound for the Philippines.