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ELECTRIC CURRENT INJURIES.

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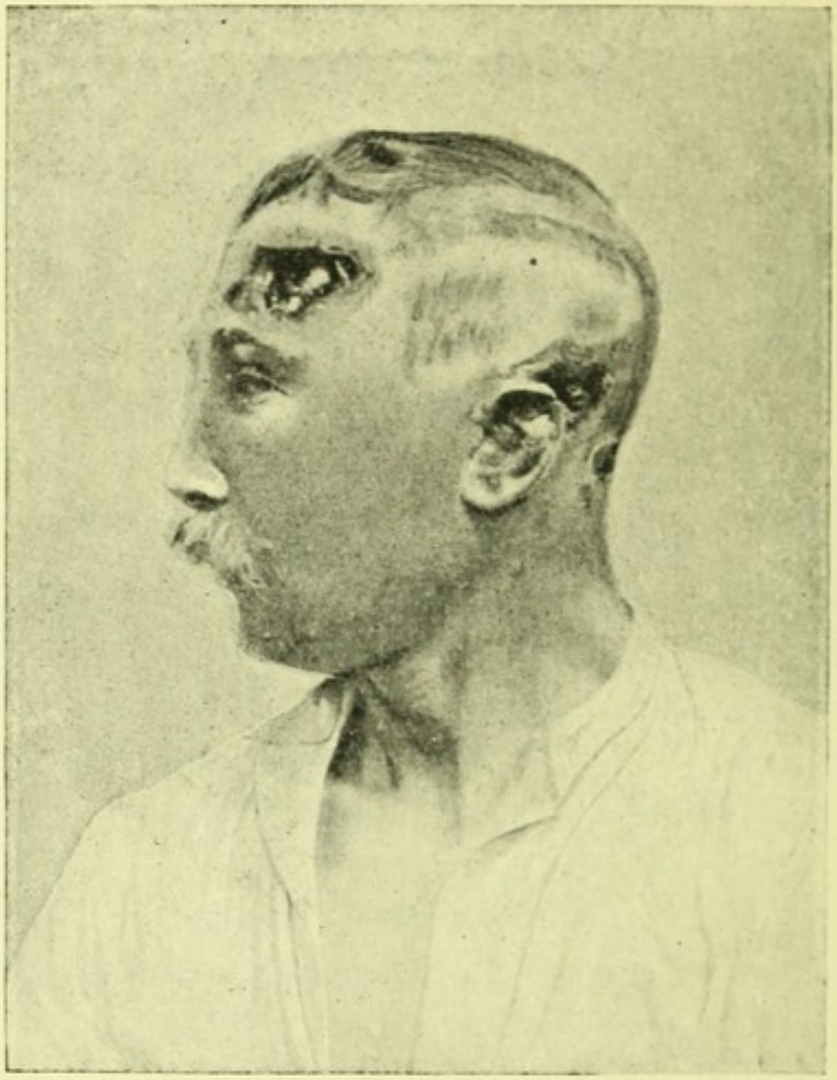
ELECTRIC CURRENT INJURIES.

THE introduction of electricity with currents of high power, for lighting public and private buildings, its extension for motor and tram services, and for therapeutical purposes, has produced a class of injuries which were unknown until the last few years. The following cases present features of interest bearing on these accidents :

J. M—, æt. 29, an ex-soldier, strong and healthy, was admitted into the Royal Portsmouth Hospital on December 30th, 1902. Whilst employed as a labourer, in the construction of the light railway between Cosham and Horndean, he grasped a wire which had broken from its pole connection. He fell, and the left side of his head came into contact with the wire charged with a current of 500 volts. He stated that there was no immediate sensation of burning, but that in a few minutes his hands, and his head especially, became painful. He felt dazed, but did not lose consciousness. When brought to the hospital two hours later he was suffering from shock ; no paralysis. There were superficial burns with a seared line on the thumb and two fingers of the right hand, and three severe burns on the left side of the head, the anterior of which extended to the bone. The burns on the hands and two of those on the scalp healed quickly, but the healing of the

largest and deepest of the scalp wounds was retarded by the exfoliation of a portion of the parietal bone, which was



removed on April 20th. The man was discharged well on May 14th, 1903.

F. F—, æt. 26, was admitted on May 10th. Whilst stooping to fasten his bootlace, near an electric light column in the street, the door suddenly flew open, and a tongue of gas flame shot out. He was knocked down and rendered unconscious.

On admission he was still unconscious, and remained so for two hours. Respiration feeble. The right arm was extended and rigid. He was unable to raise the arm, or to bend either the elbow or wrist. The fingers were extended and rigid; right sterno-mastoid also rigid. There

were no burns. The skin over the whole of the right arm was unduly sensitive. During the first few days after admission he suffered from severe headache. A gradual improvement took place in the state of the arm, and on May 26th (sixteen days after admission), when he was discharged, the following note was made: "Some stiffness of arm remains, but he is able to raise limb, to flex elbow, and to straighten hand; sensation normal over the whole of right arm."

I am indebted to a medical friend, Dr. R. B—, for the following notes of his own case: "In the spring of 1902 I was working an X-ray apparatus on a foggy day, when the air was laden with moisture. One wire, (very slightly insulated), attached to one pole of the secondary coil of a 10 In. Rhumkoff coil, was touching the table, on which was a layer of condensed moisture. One of my hands rested on the table; with the other hand I touched the wire attached to the other pole. I immediately felt a very severe shock which knocked me backwards; the shock was accompanied by violent contractions of the muscles of the arms. I felt dizzy and faint, and was covered with a cold perspiration. The heart's action was slowed, and soon afterwards much increased, amounting to palpitation. I felt pain in the arms for three hours afterwards, and some soreness and stiffness of the arm muscles for a few days."

Remarks.—Electric current injuries may be divided into three classes—

1. Cases in which a fatal result is produced at once. It is stated (1) that a current of 1000 to 2000 volts will kill. In America, where electrocution has been adopted as the means of executing criminals, a current of 1500 volts has been regarded as capable of causing death. There are, however, many cases on record of persons having been exposed to higher voltages, without fatal consequences, whilst, on the other hand, lower voltages have caused death. Recently three deaths have occurred (2) within a

month by electrocution caused by contact of the unfortunate individuals with the "live" rail, where electricity had been employed as the motive force. In these cases the "live" rail was raised by the insulators a few inches above the level of the other rails with the result that anyone falling struck the "live" rail first. Some protection should be made where electrified portions of lines run on the level through thickly populated districts, whereby accidental contact, which brings death with it, may be prevented. Electricity kills either by suddenly arresting respiration, or by stopping the heart's action. Biraud (3) thinks that death is probably due to asphyxia following the arrest of function of the medullary centre for respiration, whilst Oliver (4) showed by a series of experiments that in most instances the effect of the electric shock was felt principally by the heart. This organ immediately ceased to beat when very high pressure currents were used, whilst breathing might continue for a few minutes longer.

2. Cases in which the chief signs are burns and their consequences.

3. Cases which are followed by symptoms of a nerve character, whether tissue destruction has been present or not.

The first case related, "J. M.," suffered from burns followed by death of bone, but there were no other signs referable to electricity.

The second case, "F. F.," received an electric shock which threw him down, caused unconsciousness, and, by inflicting damage upon the nervous system, produced a temporary paralysis, with rigidity of the muscles of the arm. This state of muscular rigidity is a frequent effect of electric current injury. Kratter, in a paper (5) on the case of a workman who was killed by a shock from an electric current, received whilst he was occupied in straining telegraph wires, states, that if an electric current of 1500 volts acts upon rabbits some of the animals live and show typical symptoms, such as tetanic contraction of muscles. The

gas flame in this case acted as the conductor. Different substances possess the power of conducting electricity in very different degrees. Much depends upon the voltage applied. Both gas flame and moist vapour act as conductors of electricity, but each has less conductivity than many metals.

This accident was caused by gas leakage. At a Board of Trade inquiry it was stated that there was no electric leakage, but that gas had escaped from a neighbouring pipe, which was found to be broken, the gas pipe and electric wire being in close proximity. When the electric light was switched on, the gas ignited and caused an explosion. The dangers from leakage of gas or electric currents are great. Hedley (6) states that this source of danger has hitherto been either under-estimated, or completely ignored, but it is nevertheless a very serious one, and in the absence of suitable precautions may lead to accidents of a grave kind.

In Case 3 (Dr. R. B.) the insulation of the wires, though it was incomplete, and the comparative weakness of conduction prevented that, which might have been a still more unpleasant experience. Workers with this form of radiation, know that the X rays themselves can do harm, especially after a long or frequently repeated exposure, or undue nearness of the focus tube to the skin. Many instances of injury to patients have been recorded, such as painful ulcers of an intractable character, some of which have been followed by fatal consequences. A case is reported (7) in which, although the skin became red soon after exposure to the Röntgen rays, the redness disappeared, and no ulcer occurred until six weeks later, when the patient had left hospital, and presumably less care was bestowed on the injured skin. A painful result of X-ray work to the operator, is a chronic dermatitis, which generally occurs on the backs of the hands. The position is accounted for from the fact that this part is usually brought nearest the tube. A dryness and wrinkling of the skin occasionally takes

place, followed by troublesome warts, which are most common upon the knuckles (8).

There is a great similarity between lightning stroke accidents and those from electrical apparatus of various kinds. The former are rare in this country. I have never seen one. An interesting case is recorded (9), which occurred in the Transvaal in 1901. A non-commissioned officer was sleeping with three other men in a tent, when a thunderstorm of great severity burst over the country, and suddenly an electric discharge killed his companions. The man who escaped with his life experienced a throbbing, burning pain in his right elbow, and pin and needle sensations extending over the thigh and leg of the same side. These impressions lasted for a few minutes only. He lost the use of his arm and leg for half an hour, but consciousness never left him. He also had several skin wounds, varying in size, and corresponding to perforations in his riding breeches and socks. He made a good recovery.

As to treatment. For burns and their results, ordinary surgical remedies are required. For those who are apparently dead from the discharge of a high electrical current, artificial respiration should be used at once.

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(1) C. Allbutt, *System of Medicine*, vol. v.
(2) Courthope Wilson, *The Times*, June 24th, 1904.
(3) Gould and Warren, *International Surgery*, vol. ii.
(4) *Brit. Med. Journ.*, January 15th, 1898.
(5) *Lancet*, August 31st, 1895.
(6) *Current from the Main*, Lewis, 1896.
(7) *St. Bart.'s Hospital Journal*, May, 1901.
(8) *Archives of the Roentgen Ray*, October, 1903.
(9) *Lancet*, November 8th, 1902.

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