over, frequent changes of the form of the tonics are most valuable. Iron, phosphorus, arsenic, potassa and bitter vegetable tonics should be alternated, with free intervals, for periods of months. The various derangements of the system should be watched and treated with appropriate remedies and every case should be constantly under medical care. The facts of the case having been studied, the question of where the medical treatment can be applied to the best advantage must be determined from the case and its surroundings.

If at home the physician must have full control and his directions carried out implicitly. When the drink paroxysm appears the course of treatment must be prompt and exact. In one case the patient goes to bed and is secluded from all sources of excitement; in another he is sent away to the country and among strangers; in a third case a few days' residence in a hospital or asylum under the care of a physician is sufficient. Hospital treatment, with its exact care and physical and psychic remedies continued for a long time give the strongest promise of permanent restoration. Wisely adapted medical treatment, based on a careful study of each case, makes it possible for the family physician to treat these cases, in the early stages, with success.

No single remedy is capable of meeting a wider range of conditions than the Turkish or hot-air baths, with free massage. Next to this is hot and cold showers, and hot packs with free rubbing. Bitter tonics and salines with regulated diet are next of importance. Elimination through the bowels, kidneys and skin freely are always essential. Beyond this the good judgment of physicians should determine when to give narcotics and when to abandon them, always remembering their danger and very uncertain temporary action. Also that the cessation of the drink craze is only temporary. If this is accomplished by drug and chemic restraint the permanency is very doubtful.

The subsidence of the drink symptom by the removal of the exciting causes and building up the system to greater vigor and health is the only rational treatment. In this the highest medical judgment possible and the greatest therapeutic skill are essential for success. The medical judgment, which will determine the exact condition in each case, and the possible range of remedies required; not any one drug or combination of drugs; not so-called moral remedies, or appeals to the will power, but a clear, broad, scientific application of every rational means and measures are demanded. A large number of these unfortunate cases are distinctly curable in the early stages, and later when chronic conditions come on the possibility of cure continues to a far greater degree than is commonly supposed.

It is the common observation of everyone that a certain number of cases recover from the apparent application of the crudest empiric and psychic agencies used in the most unskillful way. This fact furnishes the strongest possible reasons for believing that when inebriety shall be studied and treated as a disease more generally by the profession a degree of curability will be attained far beyond any present expectation. The present empiric stage of treatment should rouse a greater interest and bring the medical treatment of inebriety into every-day practice. Then the family physician, and not the clergyman and quack, should be called in to advise.

A new realm of medical practice is at our doors, only awaiting medical study above all theory, and exclusively from the scientific side.

ELECTRIC TRAUMATA, THEIR PECULIARITIES AND THEIR TREATMENT.

Read at the thirty-ninth annual session of the Medical Association of Missouri, May 21, 1896.

BY NORVELLE WALLACE SHARPE, M.D.

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Among the forces of nature that are rapidly being utilized by man in the arts, sciences and the daily needs of life, and occupying a prominent rank is electricity. Its applicability is becoming multifarious, its capabilities are unknown. We have but to glance over the columns of the press and note the casualties to realize the numerous accidents attributable to it alone. It is needless to observe that the recorded cases represent but a meager proportion of the actual number of its victims. Of the varieties used to-day, two currents stand out prominently over the others in their applicability to the needs of modern life—the alternating and direct. The alternating ranging from 1600 to 2000 voltage, ordinarily, produces our incandescent lighting system. The direct current ranging from 500 to 3000 voltage, supplies the arc lighting system, and in the lower voltage is the motive power in street railways, factories, etc. It is obvious that with the increased usage of these agents, accidents will occur in direct proportion to the complexity of factors, and insufficiency of safeguards, unless a superior attention to safeguarding be practiced. The lethal force of electricity is almost entirely dependent upon voltage or electro-motive force, being actually the result of the current in amperes, which is caused to flow through the body against its resistance, by the electro-motive force. In any electric circuit the current in amperes flowing, is equal to the electro-motive force in volts divided by resistance in ohms. This is known as Ohm's law; and for our purpose is equivalent to stating that with a given resistance the current in amperes is proportional to electro-motive force in volts, and further, the current in amperes is the actual lethal force. There are cases on record where a pressure of 500 volts has been fatal, but far the greater number of casualties have been produced by pressure exceeding 1000 volts. From 1500 to 2500 volts have been employed in electrocution, the skin resistance brought to the minimum by contact sponges of large surface, wet with saline solution. The usage of these technicalities may be clarified by the following suggestion: Imagine a pipe conveying water driven by force, the conventional hose will suffice. Thus we find that: 1, the volt, unit of electro-motive force equals pressure or head of water; 2, the ampere, unit of quantity equals quantity of water passing through the pipe, expressible in gallons; 3, the ohm, unit of resistance (produced by one ampere of current, under pressure of one volt in one second of time) equals the degree of frictional resistance of pipe. Permitting C to equal current,—quantity,—ampere; E to equal electro-motive force,—pressure,—volt; R to equal resistance,—ohm; we deduce $C = E \div R$. In medical application of electricity where the resistance within the cells is large, R should be subdivided into R', internal, and R'', external resistance; the resultant equation reading $C = E \div (R' + R'')$. But in electric lighting and power systems where an almost constant

pressure is maintained on the supply mains, the resistance of the mains is so inconsiderable, as to be negligible. Demonstration of the practicability of these formulæ is easy. The pressure required for incandescent lamps (for example) is about 110 volts (being reduced on alternating current from the high voltage of mains by means of transformers), the resistance is 220 ohms. Current to be found: $C = 110 \div 220$ or $\frac{1}{2}$ ampere for 16 C. P. lamp. The 32 C. P. lamp requires one ampere, pressure 110 volts; resistance required: $R = 110 \div 1 = 110$ ohms.

Of the various human tissues the skin presents the highest resistance to electric penetration. (Different thicknesses produce resistance of varying degree). When it is removed, destruction is markedly intensified. Skin resistance increases by dryness; moistened, especially by saline solution, it is notably diminished. Experience tends to show that a current of one or two amperes is fatal to the majority of individuals. The fact that comparatively low voltages in some cases have proven fatal, and victims of shock from relatively high voltages have recovered, does not necessarily show that some systems can withstand more current than others, but rather that the skin resistance was greater, or the area of contact smaller in the more fortunate cases (according to Ohm's law). Any current sent through the body being dependent upon the resistance offered (the skin being the chief factor), it follows that the larger the area of contact, the less resistance, and a proportionally greater amount of current is received. It is known that a 2 or 3 per cent. saline solution offers a resistance equal to about one-twentieth of that of pure water, and that sea water offers about one-fortieth. The resistance offered to an alternating current by a cubic foot of pure water at 60 degrees F. is 80 ohms 60 degrees; a cubic foot of water, plus 15-100 pound of rock salt is 7 ohms. Elevate these fluids to 212 degrees F., pure water resists to the extent of 24 ohms, the saline solution 4.2 ohms. From these data it is clear that the salinity of the sweat, temperature and humidity of the atmosphere and season of the year are all important factors in the determination of the resultant shock to an individual. Of the two chief currents, direct and alternating, the former has the greater electrolytic intensity, the latter produces no permanent chemic change. Death from either current is without doubt due to sudden and profound shocking of the sympathetic system.

The injuries resultant from electricity range from relatively trivial burns to loss of life. Of all such injuries, an overwhelming percentage consists of burns. They usually occur upon the hand or forearm and differ radically from ordinary burns and scalds, in, 1, appearance; 2, accompanying pain; 3, concomitant shock; 4, prognosis; 5, subsequent manifestations; 6, reaction to treatment, and frequently 7, result. I may mention *en passant* that during the four years these researches have occupied, I have failed in the search of literature upon this subject.¹

Appearance: The majority of electric burns, seen early, present a dry, crisped aspect, excavated and bloodless, with surrounding zone characterized by pallor. This condition changes within thirty-six hours, serous oozing obtains, the tissues soften, and hyperemia replaces the pallor.

Pain is as a rule very moderate, in some cases prac-

tically absent. Twenty-four to forty-eight hours after contact it is usually present.

Shock: Electric burns differ from other burns in that the systemic shock is from the contact, the shock from the burn *per se* being *nil*.

Prognosis, in regard to time: Electric burns average from one and one-half to three times as long in recovery as other burns; in some cases, dependent upon locality, such as proximity to bones and joints, the ratio is as 5 to 1 or more; prognosis, of results, is as uncertain as time prognosis; severe cases may progress relatively rapidly; mild cases are often persistently rebellious to recovery; usually both mild and severe cases are tedious and prolonged.

Subsequent manifestations: The rule of the electric burn, from which there are rare exceptions, is that it changes within thirty-six hours from contact to a serum saturated area, with disintegrating walls and floor, progressing to profuse purulent secretion with continued tissue degeneration. This degeneration will frequently involve nerve, muscle, tendon, joint capsule, ligaments, articular surfaces, periosteum and bone itself. Exuberant granulations springing up, the entire plain bathed in pus, complete a picture alike distressing to patient and surgeon.

Reaction to treatment is very unsatisfactory, it being apparently impossible to check the disorganizing process, especially in severe cases, with most scrupulous antisepsis or asepsis. After a varying period of from fifteen to fifty or sixty days, and often much longer, firm granulation will slowly proceed and the

Result will be as good as is ordinarily secured in other burns. In some cases, however, owing to the disintegrating process involving bones and joints, producing necrotic masses, amputation is necessary. Too much stress can not be laid upon the above clinical picture, and errors in prognosis are readily made by those who have not been brought in contact with such injuries, in regard to time and result. The sloughing almost invariably present is noteworthy. Frequently a burn which in its incipient measurements will not occupy more than a square inch of surface, will produce a subsequent area of four or five square inches, or more, due to degenerative changes. The intensity and persistence of this process, unabated by usual surgical methods, can only be accounted for, by a local trophic death, produced by electrolytic activity in destruction. This wet gangrene continues as long as the local trophic inanition lasts; and healthful rejection of sloughs, and replacement by firm granulation material, can not and does not obtain, until local trophic equilibrium is again established.

The treatment of profound shock from an electric current should be instituted upon lines analogous to those pursued in shock from other agents. The patient will be found pulseless or nearly so, respiration of the most feeble character or absent, warm skin which rapidly cools, with pallor, immobile pupils and absolute muscular relaxation. Laborde's method of tongue traction in the horizontal position or with the head upon a lower plane than the body, is advised. Frictions, heat to body and extremities, hypodermic injections of brandy, digitalis, etc., are valuable. In cases where respiration is not absolutely suspended, inhalations of nitrite of amyl, until face flushes, followed by a massive hypodermic of strychnin, will bring the vital forces together; this effect should be followed by nitroglycerin. Electric applications are *not* advised. Dissatisfied by the poor results of classic

¹ One day before this paper was read I was made cognizant of the fact that Moyer of Chicago had about a year ago produced an article on lines somewhat analogous to those investigated here. I have not seen the article, nor any other on this subject.

REPORT OF CASES ILLUSTRATIVE OF PECULIARITIES OF ELECTRIC TRAUMATA.

Name.	Injury.	Cause.	Current.	Duration of Injury.	Remarks.	Result.
G. L. . .	Burns last phalanx 3d finger left, dorsum both hands.	Electric wire contact.	Alternating.	Seventeen days.	Suppuration.	Good.
W. H. J.	Burns 3d and 4th fingers, right, 4th finger left, and right wrist.	" "	" "	Between sixty and seventy days.	Suppuration and sloughing involved, 1st inter-phalangeal joint and 1st and 2d phalanges, necrosis. Degeneration extended rapidly and deeply on both palmar and dorsal surfaces of finger, and upward upon the hand. Amputation at 4th metacarpo-phalangeal articulation.	Marked cicatrization, otherwise good.
N. F. . .	Shock.	Hand and foot contact, dynamo.	Direct.	Instantaneous.	Points of contact barely visible.	Death.
P. O'K.	Burns right hand and fingers and left forearm.	Electric wire contact.	Alternating.	Sixty-five days.	Suppuration and sloughing necrosis of phalanges. Succeeded, however, in saving phalanges.	Marked cicatrization, otherwise good.
C. A. . .	Burns right hand and fingers.	" "	" "	About ten days.	Suppuration.	Good.
R. B. . .	Burns left hand, right wrist.	" "	" "	Forty-seven days.	Suppuration and sloughing.	Good.
T. J. M.	Burns left hand,	" "	Direct.	Eleven days.	Sustained while adjusting arc lamp on a stormy night.	Good.
J. J. R.	Burns thumb 1st and 2d fingers, left.	" "	" "	Twenty-five days.	Suppuration and sloughing.	Good.
J. McE.	Burns right hand and face.	Electric "flash light."	Alternating.	Three or four days.	Ran a satisfactory course.	Good.

aseptic treatment of these cases of burns, the author, in the search for improved methods, utilized, among other agents, the following: Bichlorid solutions, carbolic solutions, pyrozone solutions, chlorid of zinc solutions, in varying strengths; peroxid of hydrogen, sterilized water, hot and cold; iodoform, dry, in emulsion and in glycerin; salicylic and boracic acids, bicarbonate of sodium, loretin, aristol, tartrate of iron and potassium in solution. And for the digestion of the sloughs, pepsin, trypsin and pancreatic extract in appropriate media. Both moist and dry dressings were employed in various cases. These agents yielded results practically analogous to the conventional aseptic and antiseptic measures of wound treatment; in some cases, the results were not as satisfactory. They should be employed as adjuvants, fitted to the demands of the individual case, to aseptic or antiseptic means, and not as substitutes.

CONCLUSIONS.

1. The skin is the chief factor of resistance in an individual sustaining an electric shock.
2. That moisture of the skin, and especially, marked salinity of sweat, favors access of current.
3. Humidity and temperature of atmosphere, and season of year are important factors in determining individual resistance.
4. Electric traumata differ from ordinary burns or scalds in duration.
5. Electric traumata differ from ordinary burns and scalds in results (noticeable in severe cases).
6. Prognosis in all cases should be guarded.
7. Rigid asepsis should be followed in the manipulation of all cases.
8. Sloughs are best removed by solution of pepsin, thus: Scale pepsin 2 grms.; hydrochloric acid U.S.P. 1 cubic centimeter, distilled water 120 cubic centimeters, washed off in two hours with peroxid of hydrogen, pyrozone or hydrozone. Application to be repeated as may be necessary.
9. Deep disintegration demands especial watchfulness for the detection of bone or joint invasion.
10. Necrosis of bone should be combatted by injecting a 3 per cent. solution of hydrochloric acid in distilled water, repeated not more frequently than every two hours. Every second day the acid pepsin solution (see above) should be used until the necrotic masses are cleared away, when gauze packing should follow. In cases complicated by tuberculosis a 10

per cent. mixture of iodoform in glycerin or a 7 to 10 per cent. solution of iodoform in ether, should be subsequently employed.

11. Persistent bone or joint invasion with necrosis, requires amputation, or in some cases resection.

12. Degenerative division of important nerves should be subsequently repaired by Levering's method.

13. Degenerative division of important arteries and veins should be repaired by Murphy's method, when possible.

14. Granulating areas, after sterilization, should when feasible be covered by large skin flaps.

15. When healing process has started, peripheral skin growth is hastened by the use of a layer of sterile gauze saturated with an iodoform-glycerin mixture, and covered by rubber tissue.

QUINSY; THE DIFFERENTIAL DIAGNOSIS AND TREATMENT.

BY J. HOMER COULTER, A.M., M.D., PH.D.

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The fact that many presumable authorities use indiscriminately the terms tonsillitis and quinsy, has led me to attempt, if possible, to emphasize the differentiation so clearly brought out by Bosworth in his late work. He was, I believe, the first to make prominent the difference between the two conditions. Admitting that the symptoms are often analogous, even more so than are usually seen in other contiguous structures, yet because the pathology is comparatively open to inspection, the diagnosis should in the ordinary case be made with approximate certainty.

Let us briefly observe the comparative anatomy of the parts; it may add somewhat to our etiologic theories. I do not find by dissection nor by any anatomic authority, that any of the muscular fibers from the palatoglossus or palatopharyngeal muscles leave the striations of those muscles and branch off into the body of the tonsil; nor do they anastomose with each other until they have passed below the triangular space occupied by the tonsil. This olive-shaped body, which we term the tonsil, is thus ensconced within its position much as the eye rocks in its bony cradle, but with a much less intimate anatomic relation to surrounding structures.

The lymphatics of the tonsil are most important