CLINICAL NOTE

NOTE ON ZINC IONIZATION AND ELECTROLYSIS

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SOME time ago Professor Leduc, of Nantes, wrote in an article :

" The zinc ion is an antiseptic of the first rank and there is no wound or ulcer which cannot be disinfected by its employment, provided its surface can be reached by the electrodes. One of its peculiarities is that it produces but little inflammatory reaction."

The following note states the physical and chemical basis of

(*a*) zinc ionization in the treatment of suppuration kept up by the irritation of an infected discharge ;

(*b*) zinc electrolysis for the destruction of tissues.

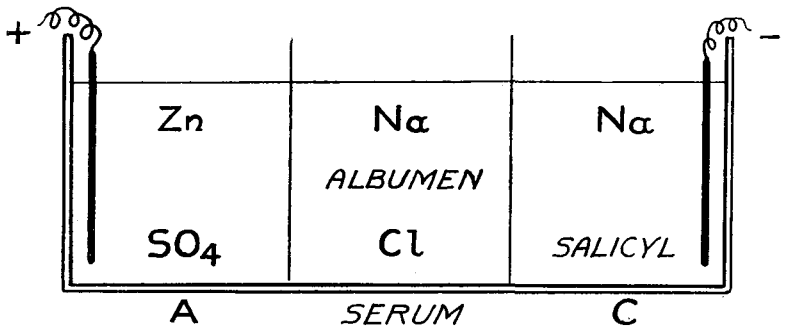
Reference is also made to some conditions in the ear and nose in which these methods can be employed.

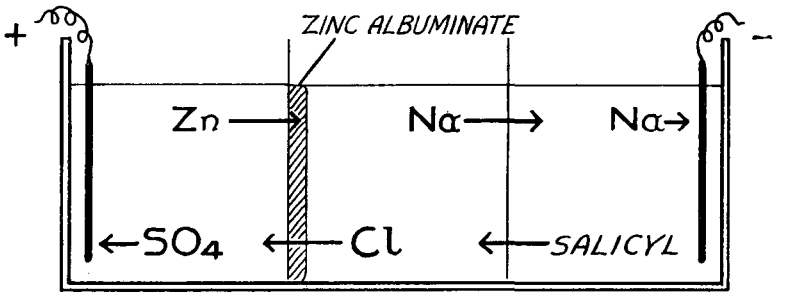
In acute suppurative inflammation of the middle ear the discharge is often so profuse that it streams from the meatus. Consequently there is not sufficient time for the discharge to be decomposed in the ear by micro-organisms. When the inflammation is subsiding the discharge diminishes and stagnates in the tympanum and meatus. There is now time for various micro-organisms to multiply in it there and convert it into an irritating fluid. Inflamed tissues are irritated by it and the suppuration is kept up. This condition is often treated successfully by various antiseptics and powders, after the ear has been cleansed, but nevertheless in every clinic there is a residuum of patients in whom the discharge persists. If each affected ear is examined and an effort made to answer the question, " What is the condition or conditions keeping up the suppuration ? " it will be found that sepsis is the basic factor in all. Frequently the whole of the septic area is accessible, as in most cases of tympanic sepsis. In other cases part of the septic area is totally inaccessible, as when the mastoid is involved ; or is accessible only with difficulty, as in some of the cases of attic disease, or of the region where the descending process of the incus is placed. In other cases there are factors additional to sepsis keeping up the suppuration, such as a polypus or granulations.

When sepsis alone in an accessible position is responsible for keeping up the suppuration, zinc ionization causes a rapid cessation of the discharge. This is due to the physical and chemical

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properties of the agents used in the treatment, as well as to the natural tendency of the tissues to cease discharging once irritation is removed.





The above diagram represents a vessel divided into three compartments by semipermeable membranes. In the middle one is serum, i.e. albumen and various salts of which chloride of sodium may be taken as representative. In A is a weak solution of zinc sulphate, and in C one of sodium salicylate, the solvent in each case being water, and the whole forming part of an electric circuit. The arrows show the direction of movement of the different ions. The positive metallic ions travel towards the negative electrode and the sulphuric, chloride and salicyl ions towards the positive. It will be seen that sodium and chlorine ions leave the middle compartment and that zinc and salicyl ions enter it. There is thus replacement of ions, but no addition to the total value.

On the positive side of the serum the zinc ions are the only ions entering it. When the zinc ions come in contact with the albumen of the serum combination takes place and a precipitate of zinc albuminate is formed. It makes a coagulum. There is a sharp delimitation between this and the adjacent serum.

Zinc albuminate is a bad culture medium for micro-organisms.

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This diagram may also be used to show what occurs when a suppurating area is treated by zinc ionization. Although the tissues are living and endowed with sensation, they are not irritated, and no reaction follows (provided the strength of current used is moderate). This is because, firstly, the ionic concentration of the tissues is not altered and no ion is introduced at the suppurating area, except the zinc ion; and, secondly, the zinc ion is rendered unirritating by combining with the albumen of the film of exudate adhering to the tissues (although these were cleansed by washing before treatment), as well as with the albumen of the superficial tissue cells. The zinc albuminate formed acts as an antiseptic coating protecting the subjacent tissues from irritation. Rest is thus assured to them and suppuration ceases.

If a weak solution of zinc sulphate is applied without the current, penetrating power is insignificant; if a strong solution is used penetration takes place but irritation and exudation also occur, since not only the ionic concentration of the tissues is altered, but another ion, e.g. SO_4 with a different action to the zinc, is also introduced at the same place.

To sum up, the secret of the success of zinc ionization in the treatment of suppuration is that there is antisepsis without irritation.

In the above treatment the zinc ions are supplied by a solution of a zinc salt. Zinc ions can also be derived indirectly from metallic zinc. Thus in the diagram, if the *positive* electrode is made of zinc, it is found that when the electric current flows, the SO_4 ions of the solution react with the zinc, which then goes into solution. A similar reaction occurs if the solution is of chloride of sodium. Since the tissues and fluids of the body contain chlorides in solution this reaction can be used to destroy tissues if a zinc wire is inserted into them, and made the positive electrode. The zinc ions spread from the surface of the wire placed in their substance. Zinc albuminate is formed in them and the actual portion of tissue coagulated is killed. Owing to the fact that zinc albuminate is a bad culture medium for micro-organisms, sepsis does not arise. The necrotic tissue gradually disappears or is absorbed. It is convenient to use the term electrolysis for this procedure. It can be made use of to reduce the size of an inferior turbinate, or to make a permanent opening into the wall of the maxillary antrum from the inferior meatus. The sphenoidal sinus can be drained in the same manner.

Thus by zinc ionization sepsis on the surface of tissues can be removed, and by zinc electrolysis tissue can be destroyed in septic surroundings without rendering the patient liable to invasion by micro-organisms, which might occur if a wound with a raw surface were made.

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