A METHOD OF PRODUCING EXPERIMENTAL SCALDS

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Our problem consisted in devising such an experimental model of burn production that we could trace the course of the disease from the initial burn shock through to the final healing of the wound produced. There was no effort made to devise therapeutic procedures to be used on the experimental animals.

Most therapeutic investigators have approached individual facets of burn problems such as treatment of burn shock, acute toxemia or local burn therapy, and so have devised production of burns to suit their individual needs.

The majority of authors studying experimental burn shock produced burns either by scalding or with flame [1-9]. As can be seen from the reading of their work, they produced burn shock in animals by causing second- and third-degree burns over 30-60% of the body areas.

Even under such conditions, shock was not always evoked, as we convinced ourselves when we employed as the burn agent a combustible mixture having a high temperature of flaming. Second- and third-degree burns covering 30% of the body area would not lead to the development of burn shock.

It is evident from this discussion that before an investigation of therapy for burn shock can be undertaken, it is essential to develop a reliable method whereby burn shock can be evoked consistently.

As is well known, the following conditions are a prerequisite for the production of shock: a definite area of involvement, intensity and duration of action by the exciting agent.

Taking all these factors into account we set ourselves the task of finding such a method of producing burns which would lead to shock when tissues of a relatively small area would be involved to not an excessive depth, and when the animal could be observed through the healing stages after it had been led out of shock.

After investigating such shock-producing burn methods as scalding water, flame and superheated steam, we came to the conclusion that when a small area involving tissues rather superficially and yet reliably leading to shock is to be used, it is necessary to decrease the temperature of the burn factor while increasing the duration of its action.

In our experiments, these conditions were met by a method which used superheated steam as the agent inflicting the burn. A similar method for producing burns involving not over 10% of the body area was evolved by V. I. Muraviev and A. K. Kozyrko in 1952 when they employed steam superheated to 200°.

EXPERIMENTAL METHODS

Steam, leaving the usual medical autoclave at 2 atmos of pressure, enters a rubber flange 2.5 meters in length attached to the outlet valve of the autoclave. To the free end of this flange is attached a spirally coiled copper tube, 0.8 cm in cross-section, which is placed over the tube of a soldering lamp (Fig. 1). This blow torch produces a flame which incandesces the copper coil and superheats the steam within it. This superheated steam exits at 200°, the temperature diminishing as the distance from the free end of the coil increases (Fig. 2).

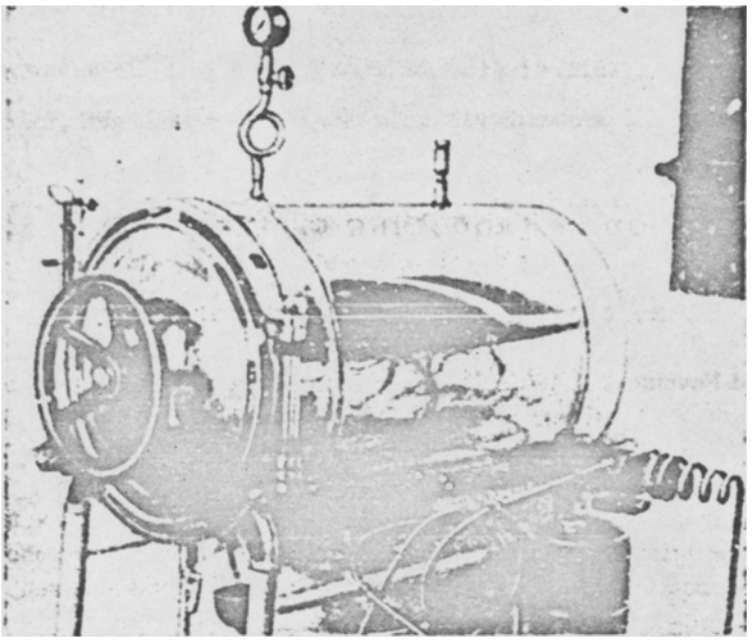

Fig. 1. Autoclave with the attached rubber flange which is placed over the spirally coiled copper tubing fastened to the tube of a soldering lamp.

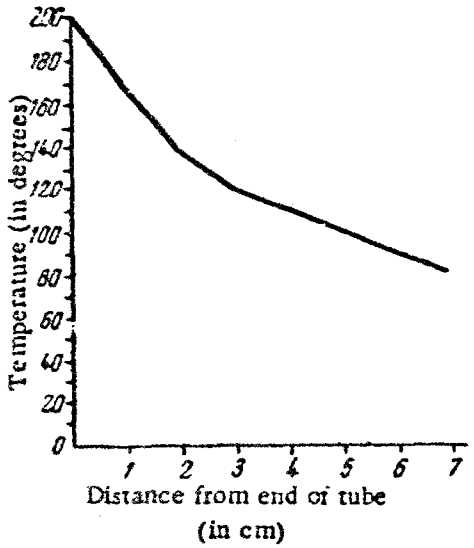

Fig. 2. Temperature changes of the superheated steam at various distances from its point of exit from the tube.

In order to inflict the burn, we fastened the dog lying on its back. The skin, over an area embracing the lower sides of the chest, abdomen and inner surface of the thigh, was shaven to embrace a skin area approximating some 15-17% of the total body area. The cardiac area and the right groin (where the arterial femoral cannula for the recording of arterial blood pressures was placed) were protected from the burn by tampons clamped to the skin.

To produce the burn, the blow torch, along with the tube attached to it, was brought to the shaven area so that the free end of the tube was 3-5 cm away from it. At such a distance, the steam has a temperature of 100-120° (see Fig. 2).

Under such physical conditions, the end of the tube was passed evenly over the entire shaven area, a burn being inflicted for a period of 12-15 minutes.

There would result on a sharply demarcated area a 2nd- to 3rd-degree burn while, at the same time, the protected unshaven area would not be involved.

Such a method permits observation of the animal from the moment of infliction of the trauma, and the basic clinical tests can be recorded.

The burns produced by superheated steam produced severe shock in 70% of cases as characterized by the following clinical tests: decrease of arterial pressure as compared with initial readings by 30% and more, tachycardia with a feeble pulse, shallow and labored respirations, weakening and up to disappearance of such unconditioned reflexes as response to pain, pupillary, corneal and blinking stimuli, fall in body temperature and in-

creased thickening of the blood. All the experimental animals which died did so either in the first hours following the burn, or, in some instances, at the end of the first day or beginning of the second. In the other 30% of instances, the dogs developed burn shock of much lesser severity, as manifested clinically by the signs just described. All these animals emerged from shock by themselves. Later, they could be followed through the successive stages leading to complete recovery.

SUMMARY

A simple method is described for producing burn shock with the use of superheated steam. When 15-17% of the dog's body is exposed to this steam at a temperature of about 120° for about 15 minutes, 2nd and 3rd burns will lead to fatal burn shock in about 70% of the cases, the other 30% recovering spontaneously and going on to healing. This method is offered, then, as being useful for future studies to be undertaken in the therapy of burns.

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