TREATMENT OF BURNS BY SILVER NITRATE, TANNIC ACID, AND GENTIAN VIOLET

BY

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The following clinical notes, though short and incomplete, may prove of interest in view of the demand for information on experience of surgery in the present war.

During recent air battles five seriously burnt airmen were admitted under our care, four within eight hours of their injury and one after forty-eight hours. These burns, though not so extensive as those seen by one of us (J. A. R.) during the evacuation from Flanders, were serious enough to warrant careful attention, and are the type likely to be met with in the future. The treatment adopted in each case closely followed the routine advocated by Dennison (1939), and it is to emphasize the excellent results obtainable by this method that these cases are described.

Case Histories

Case 1.—Pilot officer aged 27. Petrol burns of the second degree involving the forehead, nose, and complete right half of the face, the dorsum of the right hand and forearm half-way to the elbow, and the right calf for the middle three inches in its complete circumference. After the preliminary anti-shock treatment with morphine, hot sweet tea, and warming up under an improvised shock cage, atropine grain 1/100 was administered and the patient was taken to the theatre. Pentothal sodium anaesthesia was used, a total of 25 c.cm. being given over a period of half an hour. The burnt areas were scrupulously but gently cleansed with swabs soaked in ether soap, followed by saline to remove loose epithelium. They were then painted with a 1% aqueous solution of gentian violet followed by a 10% solution of silver nitrate and a 15% tannic acid solution alternately, dabbed on with gauze swabs. A firm coagulum formed almost instantaneously. The arm and leg were then wrapped in sterile towels, and the patient was returned to bed and placed once more under the shock cradle. The towels were removed, and the affected areas were thus exposed to the warmth of the electric bulbs for drying. A post-operative injection of morphine and atropine was given. Throughout the next forty-eight hours the three solutions—gentian violet, silver nitrate, and tannic acid—were applied in the above order every two hours by means of camel-hair brushes. Thereafter the solutions were applied thrice daily for another two days, and once daily for a further three days. To rest the arm a plaster slab splint covered with boric lint was applied to the volar aspect of the forearm and hand and secured by light bandaging.

Apart from a slight temperature for three days (100° F. at night) progress was uneventful. The tanned areas were completely painless and no underlying oedema developed. There were no pulmonary complications. By the seventh day the coagulum had begun to separate from the face. It peeled away from the eyelids first and, mobility being thus restored, the tendency to conjunctival irritation passed. Large areas of healthy pink epithelium were coming into view when the patient was transferred elsewhere on the eleventh day. We have since heard from Major Dennison, R.A.M.C., that this patient has now healed completely with no trace of scarring or contracture.

Case 2.—German airman aged 24. Extensive second-degree burns of the whole of the face and flexor aspect of the right wrist, with also a simple comminuted fracture of the right tibia and fibula. Resuscitation was carried out as in Case 1.

Under C.2E.3 mixture the fracture was reduced and the burnt area treated also in the same way as in Case 1. After a preliminary rise to 100° F. his progress was afebrile. Gentian violet, silver nitrate, and tannic acid were reapplied in accordance with the above-mentioned routine, the burnt areas being left exposed. Peeling proceeded smoothly without splitting of the new epithelium where exposed by the cracks in the coagulum.

Case 3.—German airman aged 35. Extensive second-degree burns of the face and forehead, the right hand, the flexor aspect of the right fingers, and the dorsum of the left hand. The patient was rescued after four hours' immersion in the sea. After appropriate anti-shock measures the routine treatment was carried out under ethyl chloride and ether. A plaster splint covered with boric lint was applied to the right hand. Recovery was uneventful: a dry coagulum with no oedema was obtained. Areas of fresh healthy epithelium were already coming into view when the patient was transferred elsewhere on the fifth day.

As illustrative of the German mentality, both this patient and Case 2 were under the impression at first that the black coagulum was a method of marking them as prisoners of war. They were speedily disillusioned, and co-operated well thereafter.

Case 4.—Flight sergeant R.A.F. aged 23. Second-degree burns of the medial side of the right arm and forearm and the lateral side of the right thigh, knee, and upper calf. These burns were due to glycol. The sergeant, in baling out, landed in a field, and a well-meaning but misguided farmer insisted on applying liberal amounts of flour to the burns. The routine treatment adopted was the same as in the previous cases. The anaesthetic was pentothal sodium followed by C.2E.3. The burns cleaned well and the coagulum took firmly. There was no oedema and no after-pain. Peeling had begun by the seventh day and was complete on the arm by the fifteenth day. It should be noted that although this patient was allowed to walk about from the tenth day onwards the coagulum remained intact, and at the time of his transfer was peeling satisfactorily at the edges.

Case 5.—Pilot officer aged 23. Second-degree burns of face and dorsum of right hand, left thenar eminence, and both heels. Admitted forty-eight hours after sustaining injury. A solution of sodium bicarbonate had been applied to the face and flavine emulsion to the hands. The large oozing raw areas with grossly swollen underlying tissues, combined with the intense pain, rendered this man's condition truly wretched.

Gas-and-oxygen was administered. The burns were thoroughly cleaned and the same treatment was carried out as before. The hand was splinted with plaster-of-Paris. Pain and oedema subsided rapidly. On the nose, purulent fluid collected and oozed through a crack in the coagulum; gentian violet, silver nitrate, and tannic acid were therefore reapplied assiduously until a firm dry crust formed. On the sixth day the patient was transferred. The oedema had disappeared and the tanned areas were dry and painless.

Conclusions

In five cases of extensive superficial burns the immediate coagulation method proved completely successful. Absence of sepsis and pulmonary complications, despite the variety of anaesthetics used, is noteworthy. This method is a definite advance on the treatment of burns, especially in war surgery.

First-aid dressing for burns is still primitive in many places.

Thorough gentle cleansing, especially of all loose epithelium, is essential before applying the solutions.

The opinion expressed by Cohen (1940) that no case is too late for full treatment in the theatre is emphatically agreed with.

Splinting the burnt limbs in the early stages to ensure rest (Cohen, 1940) and to prevent contractions is essential. No dressings otherwise are required.

The exacting routine of repeated applications of gentian violet, silver nitrate, and tannic acid solutions to produce a dry smooth coagulum is well justified by results.

We are indebted to Major H. G. Hobson, R.A.M.C., for permission to record these cases, for much help in carrying out their treatment, and for advice and many hints in recording them.

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HEPARIN IN SUBACUTE BACTERIAL ENDOCARDITIS

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The therapeutic results of the treatment of subacute bacterial endocarditis with heparin and sulphonamide as recorded in American journals (Kelson and White, 1939; Friedman, Hamburger, and Katz, 1939) are noteworthy, and justify the report of a case treated in this way. The American reports must be mentioned, but space does not permit of their discussion. They do not give an account of the bacteriological investigation and controls done in every case, and thus leave their claim to diagnosis and complete cure often open to doubt. For this reason frequent bacteriological tests were performed and recorded in the investigation of the present case.

Case Report

A girl aged 19 was admitted to Dr. Steevens' Hospital for observation. She suffered from recurrent rheumatic swellings of the joints and an old-standing mitral lesion of the heart. Her present complaints were a swollen and painful left ankle and hip, great weakness, and sweating. On physical examination she appeared normally developed, and among the abnormal findings were painful periarticular swellings of the left ankle and hip, increased heat over these joints, and some degree of limitation of lateral rotation and flexion of the hip-joint. The heart was moderately enlarged and a loud systolic murmur was present in the mitral area. During the first three weeks the patient was under observation she ran an intermittent moderate temperature, which reached 101° F. on numerous occasions. She was listless, and often delirious at night. The urine contained some albumin, a few leucocytes, and a large number of red blood cells. The blood showed a moderate degree of secondary anaemia. The blood culture was positive after thirty-six hours, the organism being *Strep. viridans*. During the following week the patient's condition deteriorated; the albuminuria became more severe, and a chain of petechial spots broke out around the neck. A blood-agar plate made with 1 ml. of her blood grew 220 colonies of the organism.

Treatment consisted of the following therapeutic agents: (1) sulphapyridine (M & B 693) was given to combat the bacteraemia; (2) heparin (the preparation liquemine of Roche Products Ltd.) was given as the anti-coagulant and probably fibrolytic agent; (3) vitamin C was administered freely to aid fibrous repair as recommended by Kelson and White.

The sulphapyridine was given orally powdered in milk, and occasionally, when vomiting was too severe, by injection. The concentration of the drug in the blood was estimated daily by Werner's (1939) method. The heparin powder was made up in 350-mg. lots and autoclaved in 1 litre of saline or glucose saline. After a priming injection of 40 mg. in 5 ml. of saline the heparin was given by continuous intravenous drip—15 to 18 drops per minute, running for nine days in succession.

An efficient control over such a slow and prolonged drip was easily obtained by the use of the rotary-pump transfusion apparatus. The effect of the drug was watched by the estimation of the clotting time by Lee and White's method (four tubes); the prothrombin time was also estimated. Vitamin C was administered in 200-mg. doses four-hourly until there was a free urinary overflow of the vitamin. A maintenance dose of 100 mg. daily was then given.

The analytical data are shown in the accompanying table.

Day of Active Treatment	Heparin (ml. in 24 hrs.)	Sulpha-pyridine (gm. in 24 hrs.)	Total Sulpha-pyridine of Blood (mg. per 100 c.cm.)	Clotting Time (minutes)	Prothrombin Time (minutes)
1st		3		7	12
2nd		3		8	10
3rd		2.5		8	10
4th	510	5.5		70	10
5th	775	3	6.0	105	12
6th	550	5.5		110	
7th	700	6	7.2	115	14
8th	500	6	9.6	130	12
9th	700	6	8.0	100	12
10th	800	6			
11th	600	6			
12th	300	6		10	

The effect of the treatment was dramatic—the heparin acted promptly, increasing the clotting time from seven minutes to over one hour. The patient came out of the listless condition, began to take interest, and even sat up in bed reading a novel. No new petechiae formed and the old ones disappeared altogether; a large subcutaneous node on the right temple also disappeared. Towards the end of the period of treatment the albumin in the urine had become much more scanty. The temperature was around normal levels during the administration of the sulphapyridine. This drug was badly tolerated at the beginning; it was discontinued on the twelfth day of treatment, when the blood count revealed a moderate leucopenia with a very toxic appearance of the white cells. All blood cultures made during the administration of sulphapyridine remained negative. Eight days after the sulphapyridine was discontinued the patient broke out in a diffuse papulo-macular rash accompanied by a sharp peak of temperature up to 104° F. The rash was quickly followed by desquamation. A blood-agar plate made with 1 ml. of the patient's blood on that day gave rise to over 400 colonies of *Strep. viridans*. In the following week petechiae came out in repeated fresh crops. Osler's nodes appeared on the palms of the hands. The patient fell back into the same state as before treatment was started and gradually became worse. She lived for almost three months after treatment had been stopped.

The post-mortem picture confirmed the clinical diagnosis. There was an old-standing endocarditis of the left auricle and of the cusps of the mitral valve, parts of which were completely destroyed and replaced by granulations. Large infarcts were present in the spleen and kidneys.

Conclusion

Heparin proved to be a powerful anti-coagulant. It exhibited its action in a concentration of 350 mg. per litre, whereas a concentration of 250 mg. per litre remained without effect. The combined treatment with heparin and sulphapyridine was only of very transient value. This does not, however, disprove the theoretical value of its application, considering the few occasions it has been used.

We are indebted to Messrs. Roche Products Ltd. for generously making available to us without charge a sufficient supply of heparin for use in this case.

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