in two hours from 454,000 to 306,000 per c.mm., but were back to normal within twenty-four hours. As the choice of acetone by Troland and Lee appeared to be purely arbitrary we then tried the effect of an extract made by emulsification of normal spleen in Ringer's solution in the cold for twenty-four hours and subsequent centrifuging. This spleen was obtained post mortem from a child aged 3 who died from cerebellar decompression. Of this extract 5 c.cm. had no obvious effect, but 20 c.cm., corresponding to 10 grammes of fresh spleen, reduced the platelets appreciably.

Summary

The acetone extract of a thrombocytopenic spleen reduced the platelets of a rabbit more powerfully than an acetone extract of a normal spleen. A Ringer extract of normal spleen was more effective in reducing platelets than the acetone extract of normal spleen, and it appears desirable to determine the optimum conditions for extracting platelet-lowering substance from normal spleen before comparing the conditions in health and disease.

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TREATMENT OF INFECTED BURNS

BY

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The literature on the treatment of burns is legion. A great number of publications followed the introduction of the use of tannic acid by E. C. Davidson of the Henry Ford Hospital, Detroit, in 1925, which has revolutionized this branch of surgery. Many writers since have published modifications of the original technique described, with reports showing excellent results. It is therefore with some trepidation that I venture to add to a subject so extensively investigated. The tremendous increase of burns in war-time surgery may, however, render this short article of interest now, and the somewhat rare opportunity of treating and watching the progress of eighteen cases of severe burns from one of His Majesty's ships seems worth recording.

The Use of Tannic Acid

The functions of tannic acid are twofold. First, in the early stages it prevents the absorption of toxins by combining with proteins and their metabolites to form a coagulum; and, secondly, the coagulum formed exercises a protective action. Suffering and shock are prevented by the protection of exposed nerve endings, but equally important is the effect of the coagulum in rendering the surface free from outside disturbance and guiding the growth of the new epithelium.

For practical purposes a burn may be considered like any flesh wound, healing proceeding most rapidly in the absence of bacterial infection. Such conditions are of course ideal for tannic acid treatment, the burnt area being rendered aseptic by cleaning before the tannic acid is applied. In war time the difficulties of thoroughly cleansing burns are many, and delay must often occur.

Severe shock may contraindicate anaesthesia or any active treatment; transport difficulties are bound to delay the arrival of cases at the theatre. Consequently, though they may have received preliminary treatment, many burns met with under war-time conditions must be of the septic variety, and it is with such cases that this article is concerned.

Tannic Acid in Septic Cases

Burns which have been left for forty-eight hours or more may be considered septic, as no amount of treatment with ether or spirit will render them surgically clean. Difference of opinion exists as to the use of tannic acid in septic cases. Some surgeons prefer picric acid dressings unless the burn has been cleaned within forty-eight hours. Hamilton Bailey (1938) states that tannic acid treatment may be instituted as late as seventy-two hours. The cases reviewed here may help to support the contention that there is no time limit after which tannic acid treatment should be abandoned, and that good results may be obtained by its use where sepsis is fully established.

When applied to a septic surface tannic acid will form a coagulum more readily than on a surgically clean area. A crust soon dries which, if it stays in place and can be kept hard, will supply the rest and protection essential for the healing of the inflamed tissues beneath. Such treatment may be compared with that adopted by Winnett Orr for open fractures and by Dr. J. Trueta for infected wounds in Spain. The essential advantages of this method are that the surface remains undisturbed, the covering allowing epithelium to grow in from the edges, at the same time preventing the formation of fibrous tissue and piled-up granulations, which are nearly always seen when infected burns have been treated by constantly changed dressings. The speed of epithelization with such treatment is infinitely greater than when the surface is disturbed daily, and the saving of pain and discomfort to the patient beyond estimation.

Pus Formation

Pus will usually collect beneath the crust and may form in patches, or almost the whole crust may be slightly raised and fluctuation may be present. The usual teaching of removal of or incision into the coagulum under such circumstances was not adopted in these cases. If an expectant attitude is taken, within twelve hours the pus will always find its way out at some point. It may come through cracks in the coagulum, especially at joint flexures, or may ooze out at the edges. After discharging for a short time suppuration will cease, and any part of the crust which has become softened may be resprayed with tannic acid and dried. Not unnaturally the smell during the suppurative phase is somewhat unpleasant, but it is not nearly so bad as that encountered in the closed treatment of infected fractures.

Fever and Pain

Nearly all cases register a rise in temperature during this treatment. It may reach as high as 104°, but this should not cause undue anxiety, and should not be considered an indication for removal of the coagulum. In most cases the fever subsides in from two to three days.

The absence of pain during tannic acid treatment is well known to be remarkable, and the same fact applies when it is used for septic burns. Following the first application and drying little pain is experienced. A feeling of tenseness and heat sometimes exists for a few hours during the suppurative phase, before the pus has

found its way through the coagulum, but this is soon relieved. The agonizing pain, for which anaesthesia may be necessary, when infected burns are treated by daily dressings is thus avoided, and the general condition of the patient will benefit accordingly.

Use of Antiseptics

When sepsis is established the use of antiseptics in combination with the tannic acid therapy cannot render the area aseptic. Any strong antiseptic is in fact contra-indicated, as it may produce further tissue damage and prevent healing. Weak solutions of dye substances may, however, be used with the object of preventing undue bacterial growth. For these cases the tannic acid was made up in flavine solution and used in conjunction with a weak solution of methylene-blue and brilliant-green. Healing was very rapid, and it is possible that these dyes also help by stimulating epithelial growth.

The danger of softening the coagulum by using a watery solution and setting free toxins, which is very real in some early cases, is not great where sepsis is present at the beginning of treatment. If, however, the electric drier is used after each application of the dye solution softening need not be anticipated.

Description of Cases

Eighteen cases of severe burns from cordite explosions were treated in this series. All these patients were healthy men of ages varying between 18 and 40 years. In nearly all cases the hands and face were burnt. In order of severity the sites involved were: (1) dorsal surfaces of hands and forearm, (2) feet and legs, (3) face, (4) back and neck.

The degree of the burns is difficult to tabulate, as it varied in different cases and at different sites, but it may be stated that most of the men had a considerable area of second-degree burning. A fact that may be of some significance is that all had been immersed in a mixture of salt water and oil for periods varying from a half to one and a half hours. These cases were received in hospital 120 hours later after preliminary treatment in one of H.M. hospital ships. This treatment consisted of tannic acid and flavine dressings without previous cleansing under anaesthesia, which procedure was no doubt contra-indicated by the condition of the men at that time.

On admission the general condition of the patients was fair, considering what they had been through, and the danger of primary shock and toxæmia had passed. Many of them, however, were in a shocked state owing to pain and lack of sleep, and at first frequent injections of morphine had to be given. When the dressings were removed the burnt areas almost without exception were found to be septic, patches of tannic crust and solidified discharge coming off with the gauze and leaving a raw infected surface which was extremely tender. The burnt limbs were now laid on sterile towels and swabbed over with a solution of 5 per cent. methylene-blue and 1 per cent. brilliant-green. They were next sprayed with a 20 per cent. solution of tannic acid in 1 in 1,000 acriflavine, and the area dried with an electric hair-drier. No dressings of any sort were used. The tannic acid spraying and drying process was repeated three-hourly by day for the next forty-eight hours and the area occasionally dabbed with the dye mixture.

The crust which formed was sticky at first but soon became hard with the constant use of the drier. Great care was necessary at night to keep the burnt surface free from contact with bedclothes and towels, to which

it would stick with consequent removal of the crust. The backs of the legs, the front of the wrists, the neck, and the back were troublesome in this respect, and these surfaces usually took longer than the average time to heal. The use of bed cradles and the slinging of limbs with bandages were found very helpful in avoiding this contact. A thick hard crust coloured blue by the dye was successfully formed on most surfaces. In the majority of cases pus collected below the covering and dripped from its edges or from cracks at the flexures. In no case was the crust incised to evacuate pus, but further applications of tannic acid were occasionally employed to harden patches where it had become softened.

Fever was present in all cases, the swinging temperature sometimes reaching a high level at first but always settling in a few days. A typical chart is included for reference. Most of the severest burns were on the dorsal

Typical chart of a case of septic burns treated with tannic acid and dye.

surface of the hand and fingers. Daily movement of the fingers was found sufficient to prevent them adhering to each other, as the usual practice of separating them with gauze was not adopted.

Healing

From periods of five days onwards the crust begins to peel or break off at the edges. As soon as sufficient crust had come off, active and passive flexion of the finger-joints was started. Special attention should be given to the metacarpo-phalangeal joint, over which the new epithelium is always rather tight.

The edge of the crust as it receded was treated with the dye mixture till only a small central area was left. The patients seemed sorely tempted to pick off the edges of the crust as healing took place, a procedure which sometimes resulted in reinfection and delay in the date of their discharge. The time of healing in infected cases is considerably reduced by this method of treatment. Evidence of pus and raised temperatures disappeared in an average of three days. In most cases only a small scab of crust remained in the centre of the burn after twenty-one days, and the patients were ready for discharge. When the surface is constantly disturbed by the application of dressings the healing time is greatly prolonged.

This point is well demonstrated in one case in which in the early stages of treatment additional dressings of flavine were used on the back of one hand. The crust was disturbed by removal of the gauze, and finally a Thiersch graft was necessitated by excessive granulations and delayed epithelization. Healing of this hand was not complete in five weeks from the beginning of treatment. It seems certain this would not have occurred had the surface been left to heal under the crust, as the other hand, which was just as badly burnt and which was not dressed with gauze, was fully healed, with almost full movements, in twenty-three days.

After the crust is off, the new skin, which is delicate and sometimes rather tender, is treated with sterile petroleum jelly daily. Passive stretching of the skin by flexion of the fingers was persisted with by the patients themselves until full movement was obtained. No form of splinting was used in any of these cases.

Results

Of the eighteen patients treated one died of bronchopneumonia. It seems surprising that others did not develop chest complications, in view of the period spent in the sea. With the exception of one case, mentioned above, in which a skin graft was necessary, the remaining sixteen cases were ready for discharge within twenty-one days.

All these men were severely burnt and the burnt areas were septic on admission. Full movements at all joints were present on discharge and there were no contractures. Absence of scarring of face and hands was remarkable, and almost the only evidence of their burns was the appearance of the finger-nails.

Conclusions

The treatment by tannic acid and dye therapy of eighteen cases of severe septic burns has been described.

Tannic acid treatment has not failed when sepsis is established. Pus formation is not an indication for removal of the coagulum, and incisions into it are seldom, if ever, necessary.

The speed of healing is greatly impeded if the coagulum softens and comes off and gauze dressings have to be used.

Satisfactory final results were obtained. Absence of scarring and contractures was noteworthy. In burns affecting the hands normal movements and function were obtained in sixteen out of eighteen cases.

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The report on the work of the London School of Hygiene and Tropical Medicine for the year 1938-9 states that in accordance with instructions received through the University of London the School suspended its normal activities on the declaration of war. The reports of the heads of the various departments had been prepared before the end of August, and it was decided that they should be published notwithstanding the changed circumstances. A record number of students attended the principal courses of instruction during the year under review. Whether it may be possible to begin again any teaching during the war is uncertain, but it is hoped to keep together a nucleus of the staff, if not in London then in accommodation that has been reserved for the School at Cambridge and elsewhere.

Clinical Memoranda

Idiopathic Thrombophlebitis

Idiopathic thrombophlebitis is a comparatively rare condition. According to Barker (1936) two types can be differentiated: (1) The recurrent form ("migrans"), with recurrence usually within one year, characterized by inflammation and thrombosis, frequently of superficial veins, particularly involving the veins of the leg, affecting predominantly males (88 per cent.), and occurring for no apparent reason. (2) The non-recurrent form, usually affecting obese people of both sexes and involving the larger veins of the lower limb. The aetiology is doubtful, but toxins have been suspected and association with influenzal epidemics has been mentioned (Owen, 1928). Two cases recently under my observation may merit recording on account of the infrequency of the condition.

The first case, that of a schoolgirl aged 14, otherwise in perfect health and not obese, presented the symptoms of acute afebrile thrombophlebitis on the superficial veins of the dorsum of the left hand. There was no history of injury to the affected hand or arm. Prominent cords were visible, hard and very tender on pressure, and the axillary lymph glands were palpable and tender. The blood count, sedimentation rate, and blood pressure were normal, and, apart from chronic tonsillitis, no other abnormal condition was present. In the further course of the illness tenderness appeared over some of the superficial veins of the forearm, elbow, and upper arm. No definite evidence of thrombosis could be seen except in the veins of the dorsum of the hand, although some indurated veins could be felt in the forearm. Very marked chilblains developed on the fingers of the affected hand. After six weeks' duration the symptoms (aching pain in the arm) gradually subsided. The patient was attending school all the time. Treatment was confined to bandaging.

The second case, that of a girl aged 19, presented the same symptoms on the right arm, with tender and hard cords extending up to the elbow, and some swelling of the axillary lymph glands of the affected side. Again there was no record of injury. The history of this patient showed that she had had a similar attack about ten years ago, but not since. The blood count was normal. No septic foci could be detected. Her general health was excellent. The course of the illness was essentially the same as in the first case. The condition gradually subsided after six weeks. The patient was not confined to bed. Both cases came under observation during the last influenza epidemic.

The cases are interesting as they show the following features. The age is lower than that observed in the large series described by Barker. The cases do not readily follow Barker's division into recurrent and non-recurrent thrombophlebitis. The recurrence in the second case was very much later than the recurrence usually observed in these cases, and both cases occurred in female patients of younger age than that described by Barker. But they differ, too, from the non-recurrent group inasmuch as the localization of the thrombus was not in the large veins of the leg and the patients were healthy in every other respect. The aetiology remains doubtful, although one case presented a definite history of focal infection (tonsils). The coincidence of this affection with a widespread influenza epidemic may be of aetiological importance in view of Owen's observations.

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