THE TREATMENT OF UNCOMPLICATED GUN-SHOT WOUNDS

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THE TREATMENT of gun-shot wounds constitutes a significant part of the work of an accident and emergency department in this area. A common problem is the through and through wound, which does not involve damage to vital structures, such as nerves or blood vessels. The purpose of this paper is to attempt to rationalise the treatment of such injuries, and to present a series of such cases treated by the same standard technique.

METHOD OF TREATMENT

As with all serious injuries, the first priority is resuscitation. When a patient is admitted with a gun-shot wound, any obvious external bleeding should be attended to, and an intra-venous infusion set up in an uninjured limb. Where necessary analgesics should be given. When the patient's condition is stable, the extent of the injury should be assessed. In cases involving injuries to limbs, these should be examined for evidence of vascular or neurological damage, and X-rays should be taken to exclude damage to underlying bones. When all of these have been excluded, the injury should then be treated as an uncomplicated gun-shot wound.

Twenty-three such wounds were treated by the technique described below. Fifteen of these wounds involved the leg, six involved the arm, and two were shoulder injuries. Thirteen were believed to be high velocity injuries, and ten were thought to be low velocity. In all of these cases, movement, sensation, and peripheral pulses were intact, and there was no evidence of bone damage on X-ray. Under general anaesthesia, the damaged skin edges were excised and the defect in the deep fascia was extended to provide adequate decompression of the underlying muscle. Any obvious necrotic tissue was excised. This was done for both entry and exit wounds, and the wounds were dressed with vaseline gauze. The area was dressed with gauze and an elastic bandage, pressure being exerted according to the amount of oozing from the wounds. The peripheral pulses were observed at the end of the operation, and were checked post-operatively, in addition to routine post-operative observations. Prophylactic antibiotics were administered.

The dressings were left in position until the fourth or fifth day, and the wounds were then inspected. At this stage, in most cases, healthy granulation tissue had filled in the bullet track, and had extended up to the level of the deep fascia. If this stage had not been reached, a similar dressing was reapplied, and the wound inspected every few days, until the defect in the deep fascia had closed. Delayed primary suture of the skin was then performed, usually under local anaesthesia.

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If closure of the wound cannot be achieved without tension at the appropriate time, no advantage is gained by further delay, and a split skin graft should then be applied to the defect.

Of the cases in the series, two minor complications occurred following delayed primary suture. In one case mild inflammation was noted in the wound 2 days after suturing, but this settled spontaneously. A second wound was slow to heal, probably due to tension at the suture line. However this wound was satisfactorily healed 3 weeks after delayed primary suture, and all other wounds healed by first intention, without complications.

**DISCUSSION**

In mediaeval times, the effects of wounds resulting from the discharge of gunpowder were so serious that a specific poison was postulated as the cause, and treatment with cautery or with boiling oil was used, in an attempt to combat this. In 1560 Botallo was the first to suggest that the trouble was caused by retained foreign bodies and dead tissue (Watts, 1960). With through and through bullet wounds, the retention of foreign bodies is usually not a problem although the removal of particles of clothing is of considerable importance. More important is the retention of dead tissue in the wound.

Hopkinson and Marshall (1967) have shown that the damage caused by a bullet is due to the direct lacerating effect, and also to the pulsating temporary cavity which is formed. Amato et al (1971) and DeMuth (1969) have shown that the amount of damage caused by the cavitation is proportional to the velocity of the missile. The damage is also related to the density and elasticity of the tissue involved (DeMuth 1969).

The amount of damaged tissue is impossible to assess during initial treatment. Hopkinson and Watts (1963) have demonstrated, using perfusion and histological techniques, that further tissue necrosis occurs for about 3 days following injury. Lawson et al (1971) have shown that the levels of creatinine phosphokinase and lactic dehydrogenase in the blood are raised following missile injuries, and remain high until the fifth day, suggesting continuing tissue necrosis during this period. Because of this Burkhalter et al (1968) have recommended initial debridement followed by delayed primary suture. In large series, Watts (1960) reports a primary healing rate of 97%, and Churchill (1944) a rate of 95% using this technique. Lowry and Curtis (1950) have shown that the best results are obtained if the suturing is carried out between the fourth and sixth days after debridement. At this stage, the tissues are still pliable and closure is relatively easy. Lowry and Curtis (1949) have drawn attention to the fact that the wounds are usually contaminated, and that the best way to combat infection following initial debridement is to leave the original dressings intact until delayed primary suturing is carried out. Berman et al (1943) have demonstrated that this is due to the development of tissue immunity to infecting organisms. They have shown that wounds are susceptible to infection with *Staph. aureus* in the first 24 hours. Immunity develops over the next few days, and is complete by the fourth or fifth day. If the wound is traumatised during this period, and this includes trauma caused by changing dressings, the immunity is much slower to develop.
Debridement, followed by delayed primary suture has always been popular in war-time. Surgeons in every military campaign this century have learnt from bitter experience the advantages of this technique (Dudley 1973). It was thought that this was a necessary expedient in the conditions, but not applicable to peacetime practice. Taking into account both theoretical and practical considerations this form of treatment would appear to be the most effective.

**SUMMARY**

A method of treating soft tissue gun-shot wounds is described. Account is taken of both theoretical and practical considerations in evaluating this procedure.

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