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AMPUTATIONS IN BED

BY

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Orthopaedic surgeons are proud, and justly so, of their aseptic operative technique. Consequently, when one of them advocates the performance of an operation in the patient's bed one can visualize the hackles rising. My apology and excuse is, "C'est la guerre," and the emergencies of war have forced us to modify the technique which in peacetime is rightly regarded as essential.

Air raids, the mechanization of the Army, and the intensified industrial output have caused a great increase in the numbers of injuries to the limbs. Motor-cycle accidents to dispatch riders have resulted in as many as sixty-one serious fractures in six months in one provincial hospital alone. These patients are often suffering from severe shock, and multiple injuries may be present. Prompt amputation of mangled limbs before adequate resuscitation is to be condemned. Nevertheless the patient may recover to a certain extent from the primary shock, and then his condition may degenerate into secondary shock as a result of extensive damage to the limb.

Indications for Amputation

The indications are: (1) severe compound fractures or crushed limbs that cannot survive owing to interference with the circulation; (2) infection by anaerobic organisms, with spreading gangrene; (3) laceration or crushing of soft parts to such an extent that (a) the presence of the limb is retarding recovery from or accentuating shock, or (b) the subsequent scarring will leave a useless limb.

Choice of the right moment to amputate is of paramount importance, and equally so is the execution of the operation with the least possible disturbance to the patient. Temporary suspension of continuous-drip transfusion, and transport to the theatre necessitating lifting the patient from the bed to the stretcher, from the stretcher to the theatre table, from the theatre table to the stretcher and back to bed again, often have a deleterious effect. There may also be difficulty in restarting the blood transfusion, which will certainly be necessary. Multiple injuries may render transport difficult or impossible. It may, of course, be possible to wheel the bed accompanied by the drip transfusion into the theatre, and in some hospitals, and in the absence of an overwhelming rush of casualties, this may be considered preferable. A mobile surgical team might have to perform an amputation in the patient's house. For these patients amputation in bed in the ward may be a life-saving measure, and it has been found that it can be quickly, smoothly, and expeditiously carried out if carefully planned beforehand and a formal technique is faithfully observed.

Technique

Essential Materials.—Samways' tourniquet, or Callandar's modification of same; large amputation knife; dissecting forceps; amputation saw; artery forceps; catgut or silk; sulphanilamide powder; vaselined gauze arranged as a dressing and laid on wool 8 in. by 8 in. and 1 in. thick; bandages; three strips of 2-in. strapping two feet long.

Anaesthesia.—Intravenous pentothal or cyclopropane. The former is to be preferred for ease of administration.

Assistants.—Three are required, apart from the anaesthetist, if available. Two is the minimum.

Operation.—Speed is desirable and often essential. An amputation through the lower third of the thigh is described, although the same technique can be adopted for any site. The guillotine operation is of course the method of choice in these severely shocked patients. The tourniquet is applied and kept in position by one assistant, who twists it round and holds it with his hands. Another assistant lifts the limb by the foot. Mackintoshes and towels are applied, and the incision is begun on the postero-medial aspect of the limb, continued over the front of the circumference of the limb, and carried down to the bone. The bone is quickly divided with a saw, the skin being pulled up as far as possible by pressure with the left hand. The femoral vessels are clamped and tied with silk or No. 2 catgut. An assistant then releases the tourniquet slightly, and any other strongly bleeding vessel is clamped and ligatured. The generalized ooze is ignored. The tourniquet is now held tight again, and sulphanilamide powder is dusted on to the raw area. Vaselined gauze and wool are then applied to the stump and firmly bandaged on. The dressing is further anchored in place by strapping, which passes over the end of the stump from the abdomen to the buttocks and from the inner to the outer aspect of the thigh. Below are given two illustrative cases.

Case I

A munition worker aged 18 became an air-raid casualty at 2 p.m. in August, 1940. The further history of his case is as follows:

3.15 p.m.—Admitted to hospital in fairly shocked condition. Blood pressure 120/80. Pulse 80, good volume. Talking clearly and well. Compound comminuted fracture of head of tibia. Morphine given and anti-shock treatment instituted.

4.15 p.m.—Plasma transfusion given preparatory to operation.

4.30 p.m.—Condition degenerating. Cold, perspiring, and cyanosed. Blood pressure 95/60. 6 litres of oxygen given with B.L.B. mask.

9 p.m.—Condition much worse. Blood pressure 85/50. Pulse rate risen from 100 to 160. Blood transfusion administered.

11 p.m.—Amputation through lower third of thigh performed in bed.

11.10 p.m.—Immediately after operation blood pressure 70/40.

Next day, 12.30 a.m.—Blood pressure 80/60. Pulse 140.

8.30 a.m.—Blood pressure 120/80. Pulse 120. Steady gradual improvement followed.

Case II

An R.A.F. dispatch rider aged 24 had a motor-cycle accident at 8.30 a.m. on November 15, 1940. His case proceeded as set out below.

November 15, 11.30 a.m.—Admitted to hospital with severe shock. Compound comminuted fracture of tibia and fibula plus fractured pelvis. Large wound with extensive laceration of soft parts. Pulse 100—irregular and of poor volume. Resuscitation started at once.

4 p.m.—Condition improved. Complete excision of wound, sulphanilamide pack, vaselined gauze, immobilization on Thomas splint with pins above and below fracture.

November 16.—Condition fairly good. Pulse still irregular—100 and poor volume.

November 17.—Definitely improving. Pulse still irregular. At 10.30 p.m., pulse 130. Wound examined. No local evidence of gas infection.

November 18, 3.30 a.m.—Pulse 120. Some crepitus in region of wound. Toes cold though not gangrenous. Plasma with 6 c.cm. of sulphapyridine and 20,000 units of polyvalent anti-gas-gangrene serum given.

6 a.m.—Asthmatic attack. (Patient subject to recurrent asthma.) Pulse 160. Oxygen given with B.L.B. mask. Adrenaline 80 minims given slowly and intramuscularly. Gross gas infection of leg present.

8 a.m.—Slight improvement in general condition, but gangrene spreading.

9 a.m.—Extensive gas gangrene below knee. Asthma controlled, but pulse still 130 and general condition very poor indeed. Blood transfusion given. Amputation through lower third of thigh in bed.

1.30 p.m.—Pulse 96. Condition improved. Steady gradual improvement from this stage.

All my colleagues and I feel certain that if either of these patients had been moved from his bed or from the ward his chances of recovery would have been seriously diminished.

Summary and Conclusions

It is suggested that the performance of amputations in the patient's bed, in the ward, the theatre, or his own house, may be the deciding factor in saving life, since the operation can be done with the least possible disturbance to the patient.

A simple technique for amputations in bed is described.

DOUBLE INFECTION OF THE MENINGES WITH MENINGOCOCCUS AND GAERTNER'S BACILLUS

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The following case seems worth recording for two reasons—first, because it is extremely uncommon for a child to recover from one variety of meningial infection only to fall a victim to another; secondly, because the type of meningitis which proved fatal is in itself comparatively rare. The primary infecting strain was meningococcus, the secondary *Bact. enteritidis* (Gaertner's bacillus).

Clinical Summary

A female infant aged 14 months was admitted to the Royal Hospital for Sick Children on June 16, 1940. She had been well until three weeks previously, when she became feverish, listless, and drowsy, began to refuse feeds, and vomited on several occasions. On June 15 the child had a convulsion. On admission to hospital she was flushed, with staring eyes, and had a marked "meningeal" cry. There was evidence of increased intracranial pressure, so lumbar puncture was performed. The fluid was under slightly increased pressure and was turbid; the cell count was 630 cells per c.mm., and films showed that these were both polymorphonuclear and lymphocytic. Meningococci were seen, mostly lying free, though a few were intracellular. On culture a heavy pure meningococcal growth was obtained. The child was transferred to Ruchill Fever Hospital on June 17. There the above

findings were confirmed. Blood culture was negative. Treatment with sulphathiazole was instituted, and she received 20 c.cm. of sodium sulphathiazole intramuscularly and 0.75 grammes of sulphathiazole four-hourly by mouth. Lumbar puncture forty-eight hours after admission showed a clear fluid in which no meningococci were found in smears or on culture. She received 26.5 grammes of sulphathiazole in eight days, when the drug was stopped. The temperature settled within forty-eight hours of starting treatment, and progress was uneventful for almost a fortnight. On July 2, however, it was noticed that the patient was fretful and that the eyes were staring and wild-looking. There was occasional twitching of the eyes. Examination showed a paralysis of conjugate upward movement of the eyes and of conjugate movement to the right. The pupils were semi-dilated and did not react to light. An internal hydrocephalus was suspected. On July 8 there was a sudden rise of temperature to 107° F., and lumbar puncture was performed. Films showed abundant motile Gram-negative bacilli, and these were obtained in pure culture, the growth on MacConkey plates consisting of non-lactose-fermenting colonies. The child died twenty-four hours later. Necropsy showed fine adhesions between the pia and arachnoid, with considerable flattening of the convolutions. There was much inflammation of the surface of the brain, over which was a thin purulent exudate, mainly vertical. The ventricles were greatly dilated and contained thin purulent fluid.

Bacteriology

Cultures yielded a pure non-lactose-fermenting growth similar to that already obtained from the cerebrospinal fluid. Several colonies subcultured produced acid and gas in glucose, mannite, maltose, and dulcitol, and failed to ferment lactose and saccharose. No indole was formed. A polyvalent Salmonella antiserum (Oxford standards) agglutinated cultures to titre. The strain was then tested against the various O (somatic) antisera of the Salmonella group, when agglutination occurred with *Bact. typhosum* O antiserum. This fact, taken in conjunction with the fermentation reactions, suggested that the strain was a member of the *enteritidis* group, which shares with *Bact. typhosum* the O antigens IX and XII. A further series of biological tests similar to that employed by Guthrie and Montgomery (1939) was next undertaken, the unknown Ruchill strain being tested in parallel with a known culture of *Bact. enteritidis* and of its closely related Dublin variant. The Ruchill culture behaved in every respect like the *Bact. enteritidis* strain. Confirmatory serological tests were then performed, when an antiserum prepared to the Ruchill strain agglutinated the homologous organism and several known *enteritidis* cultures to approximately the same high titre. Similarly a stock *enteritidis* antiserum agglutinated in high and approximately similar dilutions several known *enteritidis* strains and the Ruchill organism. Finally, the flagellar antigenic formula of the Ruchill culture was determined by the method of Kauffmann (1935-6). As already stated, it possessed the O (somatic) antigens IX and XII. Its H (flagellar) antigens were found by performing direct agglutination tests with antisera containing individual flagellar antibodies, employing the procedure described in detail by Guthrie and Montgomery. In common with various stock *enteritidis* cultures tested in parallel the Ruchill organism was found to possess the flagellar fractions g and m. Thus the serological, like the fermentative, reactions were those of a true *enteritidis* strain. The organism proved toxic for a rabbit, which succumbed within forty-eight hours of receiving an intravenous inoculation of 1/10 of a fresh agar culture suspended in saline. At necropsy the infecting strain was recovered in pure heavy growth from the heart blood, swollen spleen, and bile. The intestinal contents also were heavily infected.

Discussion

Few examples of double meningial infection such as ours are to be found in the literature. A closely similar case is that reported by Opitz (1919) in a child of 15 months in whose cerebrospinal fluid meningococci alone were present originally. Subsequently Gram-negative bacilli appeared in films of the ventricular fluid, and a strain later identified as *Bact. enteritidis* was obtained on