When the belated decision to operate has been made, further delay is occasioned by the fact that nothing is ready; instruments usually have to be obtained from a distance, and the surgeon is taken unawares, and so has no stereotyped technique to follow. To add to these difficulties the patient's posture as he lies in bed is by no means an ideal one for this type of operation; the only possible approach through the chest wall cannot be carried out rapidly in the absence of adequate instruments, while the lighting is apt to be very poor.

Although definitely recommended by Trendelenburg, the opening of the pleura was quite inadvertent, since it was thought that the pleural reflection might be brushed well out of the way by gauze dissection. The experience of this case, however, shows that valuable time would thus be lost, and that there need be no hesitation in deliberately opening the pleura. This is especially so since in all cases some variety of positive pressure apparatus should be brought into use before the operation is completed. It must again be emphasized that the efficient and early application of such a method is probably the most important single factor in re-establishing the circulation. In experimental work *in vitro*, with perfused hearts which had been maintained in a quiescent condition in the cold chamber, I found that the most effective stimulus to restarting the beat was the stretching of the musculature of the auricles by the entry of the perfusing fluid under pressure; *in vivo* a similar effect was obtained by positive intermittent aeration of the lungs.

The fact that no adequate source of origin of the clot was found in this case is, in a way, not to be wondered at, since in many cases of fatal pulmonary embolism, both post-operative and spontaneous, it appears to be impossible at the *post-mortem* examination to trace the vessel from which the clot arose. The shape of the clot in this instance showed that it had not originated in the auricular appendix, but probably in the internal iliac vein, along which it had grown without producing sufficient changes in the surrounding endothelium to be visible. It was then carried into the circulation as a whole, and not, as is frequently pictured to be the case, a small fragment detached from it as it grew from the internal into the common iliac vein.

The small bead of pus surrounding the ligature was

likely enough aseptic and due to the chemical irritation of the antiseptic in the catgut (picric acid), but this was not put to the proof.

One further point of interest is the fact that the legs had been lightly massaged twice a day after the operation as a prophylactic against femoral thrombosis, according to the suggestion of Morison. This is of doubtful value even in the case of the femoral vein, and can obviously be of no avail in the commoner cases of pelvic thrombosis. Until our knowledge of the etiological factors which determine the onset of thrombosis is much more extensive than it is at present no rational method of prevention can be suggested. It would seem possible that the role of sepsis has been exaggerated in the past, for the incidence of embolism in frankly septic cases is smaller than in those performed with all aseptic precautions. It is at the same time true that in the majority of cases of embolism the temperature chart shows a slight rise for a few days following the operation, but whether this is due to some mild grade infection (perhaps by an ultra-microscopic organism since the ordinary pyogenic organisms are rarely recoverable at *post-mortem* examination) or is a true traumatic pyrexia remains to be proved.

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THE TREATMENT OF SOME OCULAR DISEASES WITH ULTRA-VIOLET LIGHT.

BY

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SINCE the introduction of the ultra-violet light apparatus at the Bristol Royal Infirmary we have endeavoured to arrive at some conclusion as to its effect on some of the ocular diseases subjected to this treatment. Hitherto we have been working on rather "blunderbuss" methods, as very considerable work has yet to be done in sorting out the rays most helpful in medical treatment; the rays range from the near ultra-violet through a big spectral field up to the far ultra-violet, differing considerably in their action, the short being strongly irritative and destructive, whereas the long are more penetrating and stimulative. Still, even with the present methods ultra-violet light plays a very important part in clearing up a number of ocular conditions which, in the past, have been difficult to deal with.

We have made no local applications of light to the eye, but have used the mercury vapour lamp for general radiation of the skin; the first exposure is of three minutes' duration; this is increased by two minutes at each subsequent treatment up to twenty minutes, two exposures a week being given. The distance of the patient from the burner is 36 inches. Care must be taken that the eyes are protected by suitably coloured goggles.

Diseases of the Conjunctiva and Lids.—These have all been cases of children, and of a type which has resisted

ordinary treatment. In chronic and long-standing blepharoconjunctivitis it has been our practice to have tonsils and adenoids dealt with, and an autogenous vaccine prepared from the lids when possible; it is in cases which have continued in spite of this treatment that we have found ultra-violet light valuable. The curative effect of light seems to be due to the improvement in the child's general condition, thus increasing its resistance to infection. The treatment is also very beneficial in cases of chronic and recurring sties.

Phlyctenular disease of the Cornea or Conjunctiva.—Undersized, delicate children, often with enlarged cervical lymphatic glands, respond most readily to treatment. The throat should always be examined for tonsils and adenoids, and these conditions dealt with before the light treatment is begun. Here again astonishing results are often seen in the child's general condition. As a result of light treatment the cure of phlyctens appears to be more permanent than before this method was used, recurrences being much less frequent.

Corneal Ulcers.—The chronic and recurring corneal ulcer so often met with in children, associated with conjunctivitis and blepharitis, does remarkably well under the action of ultra-violet light treatment.

Tuberculosis of the Conjunctiva.—The best result that we have had so far occurred in this disease.

A child, aged 10, was seen with a large tuberculous ulcer, situated in the outer part of the upper lid. Surrounding the ulcer were tuberculous nodules, whilst the remaining conjunctiva was thick and velvety. There was a chain of lymphatic glands in the neck, the upper ones soft and evidently on the point of breaking down. The patient was seen by a surgical colleague, who advised removal of the glands, but before doing this it was proposed to use ultra-violet light. In order to estimate the value of

this particular method no local treatment was applied to the ulcer, the eye merely being kept clean with simple antiseptic lotions. After a month's treatment the glands had become very much smaller, and those that were breaking down were hard. The conjunctival ulcer was cleaner and smaller, whilst the remainder of the conjunctiva showed obvious improvement.

Light treatment was continued, and in four months no trace remained of either the ulcer or the lymphatic involvement. The child's general condition had improved out of all recognition.

This is the only case of tuberculous conjunctivitis that has been subjected to light treatment, but the result is extraordinary when it is remembered how very unsatisfactory treatment has usually been in these cases.

Tuberculous Keratitis.—In a case which was probably tuberculosis of the cornea, occurring in a child aged 10, in which there were present a small central corneal ulcer, with grey infiltrations in the substance of the cornea, iritis, and enlarged cervical glands, the tonsils and adenoids were first dealt with, and subsequently ultra-violet light was used as an adjuvant to local treatment. The progress was slow, but there was a gradual and very marked improvement in the child's general condition, which we had not been able to obtain by any of the usual methods of treatment. The enlarged cervical glands have disappeared, and except for some corneal scarring the eye has cleared up and remains quiet.

Injuries to the Eye.—Ultra-violet light appears to be useful for cases in which the eye remains irritable after an injury, particularly if the cornea has been involved.

In one patient, a young adult who had lost one eye in childhood and received a severe injury in the other by an explosion of a detonator, ultra-violet light was tried after all local treatment had failed to allay a mild iritis and vesicular condition of the cornea. In spite of treatment the patient's general condition had been below par after the accident. He responded splendidly to ultra-violet light, the eye became quiet, and the improvement in his general health marked. The use of light seemed to give this patient just that improvement in his general condition which we had not been able to attain with other methods.

There is no doubt that ultra-violet light is of considerable value in dealing with many ocular conditions seen in children. The progress of the eye depends very largely on the condition of the child's general health, and it is in this direction that we have found ultra-violet light very helpful. Used in suitable doses it will certainly give good results where other methods have failed, but patience is needed by the operator and patient, nothing being gained by trying to speed up recovery by big doses. Nor is it a "cure-all" in diseases of the eye; further work will, no doubt, very soon show us the type of case in which we may or may not expect good results.

GAS GANGRENE FOLLOWING A MOTOR ACCIDENT.

BY

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CASES of gas gangrene are comparatively rarely met with in civilian surgical practice, and the following case is therefore thought worthy of record.

A strong healthy youth, aged 19, employed as a gardener, was admitted to the Lichfield Cottage Hospital on July 23rd, 1927, with a history of having been knocked off his bicycle by a motor car.

On examination there was a transverse laceration, about two inches long, of the left shin in its lower third; it exposed a portion of the tibialis anticus, which was lacerated. There was also a piece of skin, about the size of the palm of the hand, missing from the outer aspect of the left ankle, and the extensor tendons were thus exposed. Both wounds were ingrained with road dirt.

Under a general anaesthetic the wounds were cleansed by means of biniodide solution and a scrubbing brush, and were then swabbed with spirit. The wound edges and all obviously dead tissue were excised and a glove drain was inserted into the shin wound. Antitetanic serum, 1,500 units, was given.

At 10 a.m. on July 25th the temperature was 101° F. and the wounds were very painful, although their outward appearance was much as before. Swabs were taken from the shin wound, for bacteriological examination, and the leg was dressed again. At 7 p.m. on the same day the temperature had risen to 102° F. and the inner side of the leg was swollen and brawny. Slight crepitus, as of surgical emphysema, was noted, just above the internal malleolus. Under general anaesthesia a long incision was made on the inner aspect of the leg, dividing the skin and subcutaneous and deep fascia. Carrel's tubes were inserted, and Dakin's solution was subsequently injected every two hours.

On the morning of July 26th the patient was somewhat better.

The wounds, however, looked unhealthy, and the bacteriological report was that the swabs yielded a profuse growth of *B. welchii* and *B. pyocyaneus*. At 7 p.m. his condition was much worse. The temperature was 101° F., he was looking very toxic, and both the inner and outer aspects of the leg were swollen, brawny, and acutely tender. There was a peculiar sour odour from the wound.

The patient was therefore anaesthetized, and the wound previously made was extended. The muscle was brick red and very friable, and on squeezing bubbles of gas could be expelled. All infected muscle was therefore excised. A similar knee to ankle incision was made on the outer side of the leg, down to the muscle, a portion of which was excised. The wounds were swabbed with hydrogen peroxide and Carrel's tubes inserted; 30 c.cm. of anti-gas gangrene serum were given intramuscularly.

On the following day he was much better; 60 c.cm. of anti-gas gangrene serum were given.

On July 28th he was still improving, and a final dose of 30 c.cm. of serum was given. The wounds were still very offensive and were covered by greyish-black sloughs. They were being swabbed with hydrogen peroxide twice daily, and Dakin's solution was being injected through the tubes every two hours.

On July 30th he was still doing well, and a second dose of antitetanic serum was given. Bacteriological examinations showed *B. welchii* and *B. pyocyaneus* to be still present.

On August 5th both wounds were comparatively clean and granulating, and a bacteriological examination on August 8th showed a profuse growth of *B. pyocyaneus*, but none of *B. welchii*. The wounds were being swabbed daily with hydrogen peroxide and dressed with gauze soaked in Dakin's solution. The Carrel's tubes were removed, as they were becoming embedded in granulation tissue.

On August 31st both wounds were covered with Thiersch skin grafts obtained from the thighs. They subsequently did very well, and on September 22nd, as they were almost healed, the patient was allowed to get up.

The serum used in this case was supplied by Messrs. Burroughs Wellcome and Co., and I am informed by Dr. R. A. O'Brien of the Wellcome Research Laboratories that "it contained a large amount of *B. welchii* antitoxin and probably a small amount of *B. tetanus* antitoxin, but it was not the polyvalent antitoxin against *B. welchii*, *Vibrio septique*, and *B. oedematiens* which was used during the war."

The literature on this subject previous to the war period is somewhat scanty. Simonds¹ in 1915 collected 175 cases from the literature, 111 of which were classified as follows: Compound fractures 61, lacerated wounds 20, operation wounds 11, gunshot wounds 10, and hypodermic needle punctures 9. It will be seen that in this series compound fractures and lacerated wounds form at least 46 per cent. of the cases.

The most authoritative contribution to the subject covering the period of the war appears to have been made by Weinberg and Seguin,² who produced the condition experimentally in the guinea-pig, and definitely established the anaerobic group of organisms—of which *B. welchii*, *B. oedematiens*, and *Vibrio septique* are the chief—as its cause. They advocated serotherapy in the treatment of the condition, but insisted that radical surgical measures must also be taken, and all diseased tissue thoroughly excised.

In civilian practice Christopher³ reported nine cases from the literature, covering the period 1915-22; they were all traumatic in origin. Baldwin and Gilmour⁴ collected 64 cases by twenty-six authors, during the period 1922-27. Of these, 26 were traumatic in origin, 20 complicated obstetrical and gynaecological states, and the remaining 18 belonged to that class in which the causative organism had been derived from the patient's own intestinal canal. These authors also record two personal cases, each due to *B. welchii*, and each treated energetically by anti-gas gangrene serum and by appropriate surgical procedures. In each case the end-result appears to have been excellent.

Brickner and Milch⁵ report three fatal cases, from two of which *B. welchii* was isolated, and in the third *B. subtilis* was identified. In each case a tetanus-perfringens (Welch bacillus) serum was given in large doses and radical surgical procedures instituted.

It would seem, then, that our best hope in dealing with this condition depends on three main factors. (1) Early diagnosis is, of course, essential; (2) it is necessary to adopt the operation of épluchage, as developed during the war—that is to say, the excision of all contaminated tissue regardless of the amount of mutilation caused; (3) the condition appears to some extent controllable by the early and energetic use of antitoxic serum. This serum may be