

wound daily exposed to the sun; it healed soundly, and the patient was sent back on July 8th. A year later there was no recurrence.

The objection to rubber drainage tubes, quoted by Surgeon-General Sir George Makins,<sup>2</sup> has not been upheld by our experience, though it is probable that Rutherford Morison's system is now in use in many cases in which the rubber tube was formerly employed for the purpose of drainage.

After an experience of more than two years in a V.A.D. hospital I feel impelled to state that I have not yet met with anything materially different, as regards sepsis in wounds, from what I find in my own practice in this wild agricultural district. I am constantly seeing wounds that have been neglected for more or less prolonged periods, or treated by ignorant villagers with various abominations. These wounds are frequently fouled with earth and manure and greatly resemble the cases admitted to the hospital. It seems to me to be purely a matter of degree, with the absence in civil practice of the great depression and shock so often seen in the soldier. The treatment is much upon similar lines.

The importance of rest is great; placing the injured part in a position of immobility, with free access for dressing, where there is loss of bone in the lower limb, was found the best method of treatment. Where there is delayed healing due to persistent sepsis along the planes of fascia, and there is no necrosed bone or other foreign body, complete immobility may make the difference between success and failure. Many wounds seem to remain open, with weak, flabby granulations, especially where there has been extensive loss of tissue in the neighbourhood of the femur or the tibia. The wound heals up to a point and then remains obstinately open. Elastic pressure, as recommended by Lick,<sup>3</sup> has given good results in such cases. Plenty of padding should be employed, and there should be a fair amount of pressure. The circulation of the limb is usually disturbed in these cases of delayed healing, giving rise to one or more ulcers with depressed bases and undermined edges. In a neighbouring V.A.D. hospital radiant heat has been the most successful means of treating these wounds, but has not been in operation at this hospital.

Dealing with a class of wound often in the condition of chronic suppuration, surely the most unpromising for any kind of treatment, as it is engrafted upon a constitution debilitated by exposure and prolonged fatigue, it is pertinent to inquire the proportion of failures to successes in treatment. I can recollect only one case that was not greatly benefited after prolonged treatment. It was one in which practically the whole femur was involved. For a time he did fairly well and the wound almost ceased to discharge. Then in an evil moment I operated for an extensive sloughing of the tendo Achillis, caused by pressure from a faulty splint applied abroad, I believe. There was extensive spread of the sepsis along the limb with osteomyelitis of the femur, and the limb had to be amputated. In chronic cases it is advisable, in my opinion, to give the limb a fair chance before resorting to extreme measures, and in a great proportion of such cases conservatism is fully justified. There is less likelihood of the surgeon being placed in a dilemma in a V.A.D. hospital than in a large hospital where the cases dealt with are of recent origin. In a small V.A.D. hospital of 30 beds, staffed chiefly by Red Cross nurses, the opportunities for observation as well as treatment must remain strictly limited.

#### Conclusions.

1. Treatment in a V.A.D. hospital should be, generally speaking, upon conservative lines.
2. Complications should be looked for and the cases carefully watched, and operations avoided unless distinctly indicated.
3. If the source of suppuration is of easy access, it should be removed early.
4. In deep-seated sepsis it is better to operate after antiseptics have been given a fair trial than to permit the case to drift into a condition of long-continued suppuration.
5. Where a wound is improving, even if slowly, patience should be exercised, rather than risk a septic invasion of the surrounding healthy parts by a cutting operation.
6. All classes of septic wounds are benefited greatly by outdoor treatment; the sun bath is a potent means of inducing healthy reaction in most cases.

7. It should be recognized that V.A.D. hospitals have their limitations, and that rest, good food, fresh air, and a cheerful outlook are the factors which are of most value in the treatment afforded by them.

#### SUMMARY.

Cases admitted to Duncombe Park V.A.D. Hospital, from June 28th 1915, to June 28th, 1917.

Nature of Disability.	Result of Treatment.						Cases still in Hospital.	Total Cases that have been under Treatment.
	No. Discharged to Duty.	No. Transferred to Military Hospital Convalescent.	No. Transferred to Military Hospital for Further Treatment.	Average Duration of Treatment, in Days.	Percentage of Cases Returned to Duty or Convalescent.	Percentage of Cases Returned for Further Treatment.		
G.S.W. of lower limb ...	35	29	8	71	88.8	11.1	18	72
G.S.W. of upper limb ...	17	11	3	59	93.2	9.7	5	31
G.S.W. of chest ...	11	3	2	70	87.5	12.5	1	16
G.S.W. of abdomen ...	3	3	—	48	100	—	—	6
G.S.W. of head and neck	3	2	1	42	83.3	16.7	3	6
Rheumatism (chronic and acute)	7	2	5	65	64.3	35.4	—	14
Bronchitis and pneumonia	4	5	—	62	100	—	2	9
Nephritis ...	4	1	4	51	55.5	44.5	—	9
Heart affections ...	2	—	1	73	66.3	33.3	—	3
Frost-bite ...	3	—	—	52	100	—	—	3
Gas-poisoning ...	3	3	2	59	75	25	1	8
Neurasthenia and shell shock	2	3	3	46	62.5	37.5	—	8
Trench foot ...	6	1	—	37	100	—	—	7
Other diseases ...	11	2	3	42	81.3	18.7	—	16
Total ...	111	65	32					208

(a) The hospital accommodation was increased from twenty-two beds to thirty beds in May, 1917.

(b) In cases of multiple wounds the regional details are given of the most severely wounded parts only.

(c) The average duration of treatment in days for all cases was fifty-eight approximately.

#### REFERENCES.

<sup>1</sup> BRITISH MEDICAL JOURNAL, January 20th, 1917. <sup>2</sup> Ibid., June 16th, 1917. <sup>3</sup> Ibid., May 19th, 1917.

## THE TECHNIQUE OF THE CARREL-DAKIN TREATMENT.

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IN the following description of the method used in the Carrel-Dakin Ward, which has been in operation at the Duchess of Connaught Canadian Red Cross Hospital, Taplow, for fifteen months, standard methods are, as much as possible, passed over, and those details which have been introduced during the last year especially described.

The solution is prepared daily in the dispensary according to the method of Dr. Daufresne,\* tested for hypochlorite content, and sent to the ward in a carboy of amber glass, without the addition of the potassium permanganate. The solution is at once tested by one of the surgeons, and if found of correct strength, the potassium permanganate is added and the bottle stored in a closet until used.

A study of the wounds treated with solutions of different strengths of hypochlorite has convinced us that the upper limit of strength of Dakin solution should be reduced. The use of the solution around 0.5 per cent. often causes

\* The Dakin solution is prepared according to the technique of Dr. Daufresne as set forth in the circular of the laboratories of the Rockefeller Institute at Compiègne (Mission of Dr. Carrel), dated December 15th, 1917. The amount of potassium permanganate used to stabilize the hypochlorite is 5 mg. to each litre of Dakin's solution.

the wounds to develop a scalded, white appearance not seen with the lower strengths. We have endeavoured to limit our Dakin solution to between 0.460 per cent. and 0.485 per cent., between which percentages we consider we obtain the best results.

All the Dakin bottles in the ward are fitted with a rubber cork, rubber tubing, and pinch-cock. This was found to be more satisfactory than closing the mouths of the bottles with cotton-wool. Pinch-cocks on both stopper and irrigating tube are opened when the solution is being used.

A series of tests was conducted to determine the action of light on the solution in different types of protected bottles. The tests were made with Dakin solution in bottles exposed to winter light on a verandah. More marked results would be expected in the brighter light of summer. The first bottle was uncoloured glass, the second was thoroughly shellacked with Bismarck brown (amber-coloured glass bottles being unobtainable), whilst the third was enclosed in a bag of heavy duck impregnated with a brown floor stain.

*On beginning the test—*

The strength of the solution was hypochlorite 0.499150 %

*At the expiration of 24 hours—*

Uncoloured glass bottle showed hypochlorite...	0.406125 %
Bismarck brown bottle                   "                   "	0.473075 %
Duck covered bottle                   "                   "	0.487975 %

*At the expiration of 48 hours—*

Uncoloured glass bottle showed hypochlorite...	0.379950 %
Bismarck brown bottle                   "                   "	0.461900 %
Duck covered bottle                   "                   "	0.473075 %

These figures prove (a) that the brown duck covered bottle is the best for the protection of the solution, and (b) that, properly protected, the solution will retain its potency for at least forty-eight hours. Hence we use only the brown duck protected bottles.

A well-equipped dressing carriage is essential. A liberal supply of instruments, including eighteen pairs of thumb forceps, several pairs of scissors and sinus forceps, is needed. We use several syringes with rubber tubing and nozzle attachment to avoid any hand contact with wounds, also a separate container with long forceps for the use of the nursing sister, all instruments being sterilized after use by ten minutes' boiling.

We consider the disinfection of the Carrel tubes and the preparation of the vaseline pads most important. The Carrel tubes, after use, are syringed out with warm water, scrubbed with a brush, soaked all night in Dakin solution, washed off with ether, and then boiled for thirty minutes in a caustic soda solution.

In the preparation of the vaseline pads, ordinary dressing gauze with eight or ten threads to the inch is entirely unsuitable, as it does not retain sufficient vaseline. Cheese cloth, with twenty-four threads to the inch, gives the best results. This is cut in strips 6 in. by 4 in., one end turned up, and, in sets of twenty, dipped into hot vaseline. The surplus vaseline is drained off and the strips are placed neatly in layers, in a tin box with a perforated lid. This is repeated until the box is full, when the box is pinned up in a towel, and sterilized in the operating room. The resulting pads are thoroughly impregnated and adhere perfectly to the skin, allowing no Dakin solution to penetrate.

In the Dakin service at this hospital the medical officer invariably does all the dressings. This rule is rigidly enforced, as in no other way can there be certainty of the technique. It is possible for one medical officer to dress fifty cases a day, but it is difficult where his work also includes operations and clerical work. We have hence found two medical officers necessary for such a ward. As assistants we have one nursing sister (well trained), and two orderlies, one of whom may be an intelligent convalescent patient. Both nursing sister and head orderly are fixtures in the ward, as satisfactory team work and thorough asepsis are only obtained by permanent assistants. Their duties include no ordinary ward work, and are limited to the dressings and preparation of the same. One orderly looks after the sterilization and delivery of successive instruments; the other assists with the patients and on the carriage. The sister's attention is restricted to the carriage, handling all instruments and dressings by long forceps. In handing the medical officer the various instruments, tubes, and dressings, the sister's forceps are not allowed to touch those used by the surgeon.

The essential point of the dressing technique is that the wounds, tubes, and dressings, are on no account touched by the hands. Everything is handled solely by clean dressing forceps. No patient who is to be dressed should have Dakin solution less than two hours before the dressing. This ensures that the bacterial count is not diluted. After the old dressings are removed, a smear of the wound is taken on a clean glass slide, on which is marked the patient's name and the date. The slides are collected, and taken to the pathological laboratory, where the bacterial count is made and entered in a book, from which entries may be made on the patient's case sheets. Wounds are syringed with normal saline or Dakin solution. The surrounding skin surfaces are then carefully dried. One ply of the vaseline pads is next applied accurately to the edges of the wound and well smeared to the skin. It is most important that these pads should have sufficient vaseline so that they may adhere firmly. This allows any overflow of Dakin solution to pass over the vaseline and be absorbed by the large pads. If not, the Dakin solution passes under the pads and a most obstinate "Dakin dermatitis" results. These vaseline pads should be applied to a greater depth from the dependent sides of the wound. Carrel tubes are next applied. Surface wounds may be covered with a single layer of gauze, which may be kept in place by making it adhere to the vaseline pads surrounding the wound. A large pad of suitable size, made of absorbent cotton covered with gauze, is then applied. The idea of this pad is not to cover the wound, but to soak up any discharge which may result from the treatment. It has been our experience that wounds do much better when not completely shut off from the air. In the case of a wound on the anterior surface of the leg, this pad would be applied around the under side and pinned at each end, leaving the wound uncovered by the large pad. Forceps are changed after the old dressings are removed, and the Carrel tubes should be handled by clean forceps.

One of the hardest things is to keep the tubes in position in a large flesh wound. This can be made easier by employing specially shaped tubes. For long flesh wounds we employ a tube tied an inch or two from the end; holes are punched in it corresponding to the length of the wound. It is kept in place by strips of adhesive tape at each end of the wound. Rings of various sizes are useful not only for encircling the ends of stumps, but often are much easier to keep in position on flesh wounds. The object of placing Carrel tubes in a wound is to ensure that the flow of Dakin solution will cover the entire surface. The position of the patient at the time of dressing must be taken into account, as it may not be that which he usually occupies.

#### Conclusions.

We wish to emphasize the following points in the operation of a Carrel-Dakin ward:

1. All Dakin solution should be tested personally by the surgeon before use.
2. The upper limit of hypochlorite is best at 0.485 per cent.
3. Brown duck bags give the best protection to the solution.
4. Well-equipped dressing carriage and good team work are essential.
5. Vaseline pads properly made and properly applied give the best protection against "Dakin dermatitis."
6. Absolute "joint" asepsis in dressings is essential.

The results obtained with this technique have been most satisfactory in the majority of cases. The asepsis has to be rigid. The handling of everything with forceps is a little awkward at first but dexterity is soon acquired. Good team work, with a thoroughly trained, conscientious surgical nursing sister and two intelligent orderlies, combined with rigid "joint" asepsis, has given us surprising results.

AMONG the rectors of the Italian universities nominated for the academic year, 1917-18, are two representatives of medicine. These are Dr. Roberto Binaghi, professor of clinical surgery in the University of Cagliari, and Dr. Pio Colombini, professor of dermatology in the University of Modena.