upper limb following saucerization and vaselin packing, and out of about 200 surgical cases it was not uncommon to have twenty or thirty patients going about wearing them. The Chinese wounded soldiers got very attached to them, and called them their anti-aircraft guns.

Messrs. J. Critchley and Sons of 18, Great George Street, Liverpool, have kindly offered to supply the splint to anyone interested, and they have also made plans for an improved model, one of the chief features of which is that it is collapsible.

HYPOVITAMINOSIS-C AND PULMONARY TUBERCULOSIS

BY

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The state of vitamin C unsaturation existing in pulmonary tuberculosis (Heise and Martin, 1936; Hasselbach, 1936; Abbasy, Harris, and Ellman, 1937; Hurford, 1938) has been found so gross as to suggest some specific relationship. Encouraged by this, Petter (1937), Albrecht (1938), Hurford (1938), and Bakhsh and Rabbani (1939) have tried the effect of saturating tuberculous patients with vitamin C for variable periods in the hope of obtaining benefit. The improvement in weight, sedimentation rate, and temperature recorded by Albrecht and the regression of infiltration observed by Weber (1938) were apparently specific, and stimulated us to verify, if possible, these happy results.

Method of effecting Saturation, and Findings

Employing macroscopic urinalysis based on the method of Harris, Ray, and Ward (1933), we found during the winter months that trouble was caused by the freezing of glacial acetic acid, and were therefore obliged to substitute 33 per cent (*B.P.* strength) acetic acid and modify the calculation accordingly. Apart from this one alteration, our technique did not materially differ from that in general use, which involves the employment of dichlorophenol-indophenol as an indicator and necessitates rapid titration soon after micturition.

The total daily urinary ascorbic acid excretion was estimated for three consecutive days, the average value for all patients being 13 mg. daily, with extremes of 7.4 and 25 mg. While the degree of hypovitaminosis was roughly proportionate to the severity of the infection, occasional inconsistent results rendered it unreliable as an index of severity. In order to remedy the unsaturation we at first administered 500 mg. of ascorbic acid by mouth daily to each patient until an excretion level of 250 mg. was obtained, but it sometimes took as long as a fortnight to achieve this object, most cases requiring a total of 6 to 7 grammes. By experiment we found that it was possible to administer a large preliminary dose of 5 or 6 grammes, followed by 1/2 or 1 gramme doses until at least 250 mg. was excreted, and the majority of our patients were saturated by this rapid method. Harris, Ray, and Ward (1933) give a normal excretion rate of about 30 mg. daily, and, accepting this standard, we maintained the excretion rate, after saturating, at a level of 40 mg. or more in order to exclude the possibility of partial saturation. Every

fortnight the total daily output of each patient was checked, and the maintenance dose altered if necessary. Between 100 and 200 mg. daily sufficed in even the more extreme cases, but throughout the test period patients avoided fruits containing excessive amounts of ascorbic acid, oranges only being allowed at the rate of 35 mg. per orange in substitution for part of the maintenance dose. Saturation was maintained for six months in the surviving cases.

Selection of Cases

The average case of pulmonary tuberculosis undergoing sanatorium treatment is so apt to become apyrexial, to gain weight, and to improve by all the usual criteria that such a case would be unsuitable for testing this new remedy, for at least two imponderable factors—rest and vitamin C saturation—could be held responsible for any improvement noted. Hence we selected our cases from two more suitable groups: (a) acute or bronchopneumonic cases with marked pyrexia, unlikely to improve on any known form of treatment; and (b) "bad chronics"—that is, cases with fairly extensive disease which, after a reasonable period of observation, were found to be making no progress or were even slowly retreating. Twenty-four cases in all were treated, seven being acute and seventeen "bad chronics."

Results of Treatment

In analysing the results we have excluded appetite and cough as indications of improvement, it being clear that these subjective symptoms are too vague and too suscep-

Table showing Results of Treatment

	Improved	Unchanged	Worse
Fever	2	7	4
Pulse	2	7	4
Weight	3	1	9
Sputum quantity	—	5	8
Sedimentation rate	4	1	8
X-ray appearance	1	0	12

tible to the suggestion of benefit from a new and special treatment. With the exception of the sedimentation rate, which is often in direct ratio to the degree of toxæmia, we have excluded blood changes as criteria of improvement. An improvement in coexisting anaemia might well follow the administration of ascorbic acid, but though the general well-being would thereby be increased the improvement would be unrelated to the pulmonary condition and therefore confusing. All of our cases were bacilliferous at the beginning of treatment and remained so throughout. Eleven patients died during the investigation, hence the inclusion in the table of only thirteen cases, of which one was acute and the remainder were "bad chronics."

It will be seen that on all counts, especially radiologically, the general tendency is to stability or deterioration. Of the original twenty-four cases only one was considered to have shown a net improvement at the end of six months' treatment. The uniqueness of this result forbids the conclusion that it was due to the treatment.

Complications.—Several of the patients were suffering from laryngitis or enteritis, but in none of the survivors was any improvement in these complications noted. One patient was suffering from amyloid disease, which was not materially benefited, while another developed meningitis and died, in spite of adequate saturation.

Haemoptysis.—One fully saturated patient suffered fatal haemoptysis, while another died of bronchopneumonic spread a few weeks after a severe haemorrhage which

occurred during treatment. In another instance (not included in the analysis) a pneumothorax patient suffering from repeated small haemoptyses was rapidly saturated, but without effect. Haemorrhage ceased spontaneously a fortnight later, the adhesions were cauterized, and there has been no recurrence of this complication.

Conclusions

Ascorbic acid is of no value in the treatment of pulmonary tuberculosis and its complications, including haemoptysis, for which most benefit might be expected. Saturation with the vitamin neither contributes to recovery nor retards retrogression.

As hypovitaminosis-C is encountered in many infections the state found in this disease must be assumed to be the result of toxæmia, and is therefore non-specific.

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THE DIAGNOSIS OF JOINT INJURIES

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The diagnosis of injuries to joints can be greatly simplified if a few simple rules, based on an understanding of the potential dysfunction caused by trauma, are clearly borne in mind and their application to the physical examination of the injured joint mastered.

Physical Signs

Every injured joint presents well-defined physical signs which point directly to the site and often to the nature of the injury. Injuries of joints fall into two classes—those which involve the interior of the joint and synovial and articular surfaces, and those which involve the ligaments and/or tendons immediately related. In some cases both classes of injury are present independently, while in others they may be complementary: for example, a sprain of the internal lateral ligament is, I am convinced, a condition precedent to displacement of the medial meniscus of the knee-joint. Injuries of the ligaments alone, without injury of the internal joint surfaces, are much commoner than injuries affecting the latter without ligamentous injury. In my opinion, based on an experience of several thousand cases over a period of nine years, there is no such entity as a simple traumatic synovial effusion, it being almost impossible, mechanically speaking, to injure the synovial lining of a joint so long as the fibrous capsule with its ligaments and the articular surfaces remain intact. Careful examination will invariably disclose the extrasynovial injury, and restoration of full function depends upon that diagnosis being made and the injury to the ligamentous structures treated.

Inspection should precede every other examination of an injured joint, and any deviations from normal outline, the presence of swelling and/or discoloration, and the position in which the joint is held should be noted. Very often considerable information will be afforded by this

simple procedure, and data such as the inverted-horse-shoe-shaped swelling around the patella in large effusions of the knee-joint will be obtained.

Determining Class of Injury

The next step is to determine which of the two classes of injury already mentioned is present, or whether the injuries affect both the internal joint surfaces and some or all of the extra-articular ligaments. To this end the passive and active movements of the joint must be studied and the findings assessed in the light of the following two rules, based on the teaching of the late Sir Robert Jones:

Rule I.—When disease or injury involves the interior joint surfaces, synovial or articular, all the movements (passive and active) of the affected joint are limited.

Rule II.—If any single movement (passive or active) normal to a particular joint is completely free the disease or injury present does not involve the interior joint surfaces.

Injury to Ligaments

Whether the injury has been found to involve the interior of the joint or not it next becomes necessary to examine the joint for injury to the ligaments related to it. In order to perform this part of the examination accurately and with the minimum of discomfort to the patient it is necessary first to have a clear conception of the anatomical position of the ligaments in question and to examine each one systematically. Bearing in mind that a sprain may be properly defined as "a rupture of some or all of the fibres of a ligament or tendon," I have come to the conclusion that before it can be diagnosed with certainty two criteria must be satisfied: first, there must be pain referred to the site of injury when the injured ligament is put on the stretch; and, secondly, tenderness on pressure at the site of injury must be elicited, the ligament being relaxed. The following rules for examination must therefore be observed:

Rule III.—Without touching the suspected ligament, manipulate the limb so that the ligament will be stretched; if it is torn the patient will now refer pain to the site of injury.

Rule IV.—Without touching the suspected ligament manipulate the limb so that the ligament will be relaxed; now palpate systematically along the course of the ligament. If it is torn the patient will complain of tenderness—that is, pain on pressure—localized to the site of the injury. If the examiner is experienced he will also be able to feel the effusion present at the site of injury.

If these two rules yield positive findings, and only if *both* are positive, a diagnosis of a tear of the ligament examined can be made. The examination should be conducted in the above order because if tenderness has been elicited over the ligament the patient is likely to refer pain to that area during the subsequent manipulation. This order of examination, carried out in the manner described, is useful in the detection of malingering, unless the patient has a considerable amount of anatomical knowledge.

Indications of Fracture

It now remains to palpate in a careful systematic manner the bony prominences related to the joint, seeking points or lines of localized tenderness indicative of fracture according to the following rule:

Rule V.—With the joint in the position of ease, palpate the subcutaneous bony surfaces and outlines around the joint systematically: a strictly localized area of marked tenderness indicates a likely line of fracture; if this be present an experienced examiner will be able to feel the actual line of separation.