the blood after parathyroidectomy from 400 per cent. to 1,200 per cent.

It was thought that the action of guanidin in causing tremors of the excised muscle of the frog might be used as a test for its presence in the blood after parathyroidectomy. Wishart studied the action of the blood of parathyroidectomized animals upon such muscles. His experiments show that while the blood of normal animals fails to cause any twitching or any alteration in the form of contraction of the muscle, in several cases twitching, and in a greater number prolongation of contraction, occurred.

H. *The Metabolism after Parathyroidectomy and the Administration of Guanidin.*

A series of experiments carried out by Burns shows the similarity of the changes in the distribution of nitrogen in these two conditions.

These investigations have shown also the close association of idiopathic tetany in man and that following removal of the parathyroids, and that in both the symptoms are due to an increase of the guanidin in the body, but before remedial measures can be considered the exact nature of the change in metabolism must be further investigated. Degenerative changes in the liver have been described by Gozzi and others. Are these primary? Are they the cause of the development of guanidin or are they the result of its action? The question of the source of the guanidin has also to be investigated. It is known to occur in arginin, which is one of the constituents of most proteins. Is the guanidin formed directly from it? Normally the guanidin part yields urea, but a disturbance of metabolism might lead to its persistence as guanidin or methyl guanidin. Again, guanidin is the chief constituent of the creatin of muscle, and it might be derived by some change in the formation of a decomposition of this substance. So far the studies in metabolism afford no indication that such a change occurs, but further work upon the question is in progress.

CONCLUSIONS.

1. The symptoms of tetany are due to some change in the nerve cells of the cord, and the increased excitability of the neuro-myon is caused by an action on the nerve endings.

2. A comparison of the symptomatology of idiopathic tetany, post-operative tetany in man, tetania parathyreopriva, and guanidin poisoning in animals leads to the conclusion that all these conditions are of the same nature, and that the first three are due to the development of guanidin in the body as the result of some interference with the action of the parathyroids which normally control the guanidin metabolism, and by so doing probably influence the tone of the muscles.

3. There is a close association between idiopathic tetany in man and that following removal of the parathyroids; in both the symptoms are due to an increase of the guanidin in the body.

4. It will only be possible to consider remedial measures when these various problems have been cleared up, and further prosecution of the investigation by the combination of clinical and laboratory study seems to hold out the most hopeful promise of further advances.

The work has been done as part of an investigation upon rickets which is being carried out under the Research Scheme of the Medical Research Committee (National Insurance Act). The expenses of the earlier work were partly defrayed by the Carnegie Trust (Scotland).

[The Warren Triennial Prize in 1916 was awarded for this series of papers at the Massachusetts General Hospital. This statement is made at the request of the trustees of the hospital.]

In the German academic year 1914-15 licences to practise medicine were granted to 1,038 men and 72 women. The corresponding figures for the preceding year were 3,822 and 148. This big drop was due to the granting of licences to many advanced medical students at the outbreak of the war. Thus, for the year 1912-13 there were 1,447 licences granted as compared with 3,822 in the following year, which included the first period of the war. The number of women medical students has increased from 334 in the winter term of 1908-09 to 1,229 in the corresponding term of 1915-16.

SIMULTANEOUS LIGATURE OF ARTERIAL AND VENOUS TRUNKS IN WAR SURGERY.

BY

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CERTAIN surgical ideas have undergone a complete revolution as a result of the additional experiences gained in the war surgery of the past two and a half years. Among these changes perhaps one of the most striking is the difference in attitude towards the question of simultaneous ligature of the main artery and vein of a limb.

C. G. Spencer,¹ writing on this subject, says: "If the vein is wounded as well as the artery the danger of gangrene is greater." In Jacobson's *Surgery*² is a short paragraph on ligature of the popliteal artery in which the following warning is given: "It would be well if possible to get leave for immediate amputation if the vein was found injured also, and beyond remedy by suture." Major A. J. Hull³ says: "Ligature of blood vessels appears to be free from dangerous sequelae. Three exceptions may be made to this observation—the common femoral and the popliteal on account of the liability of gangrene of the limb, and the carotid vessels on account of their distribution to the brain." Lastly, among the small number of authors available at the time of writing, Penhallow,⁴ referring to aneurysmal varix, says: "Great care should be taken not to injure the vein, as otherwise gangrene may result. It may be said that the vein is the more important vessel of the two in this respect."

The modern views on this important subject are clearly expressed by Surgeon-General Sir G. H. Makins in his Hunterian Oration of this year (1917). This authority goes so far even as to advise simultaneous ligature of the vein in those cases where it is found necessary to tie a damaged artery, "whether the vein be wounded or no." He gives the following reasons: First, "The elimination in part of the capacious main vein is a real advantage since this for the time affords a too ready channel of exit for the diminished arterial supply as well as an undesirable reservoir for stagnation." Secondly, "The result of the combined procedure being to maintain within the limb for a longer period the smaller amount of blood supplied by the collateral arterial circulation, and hence to improve the conditions necessary for the preservation of the vitality of the limb."

It should be remembered, as Sir G. H. Makins⁵ and Delorme⁶ have pointed out, that in many injuries of the arteries the vein is also contused and later becomes thrombosed. That the converse is true is well illustrated in Case v. The venous system may be even further restricted without loss of circulation occurring. In Case i, in addition to the popliteal artery and vein, both internal and external, the saphenous veins were tied, and the limb survived.

The following cases, which with one exception have all occurred at a casualty clearing station in the past few months, show the beneficial result of simultaneous ligature of the main vein where the corresponding artery is damaged beyond repair.

Case v is of interest because severe local sepsis was present with commencing gangrene of the group of wounded muscles. A thrombus was removed from the superficial femoral artery, which restored the circulation long enough for healing to commence, before the lumen became again occluded. Case vi, operated on by my colleague Captain G. McMullan, R.A.M.C., is an example of the benefit derived when this method of treatment is applied to the tibial vessels.

Injuries of the posterior tibial artery, whether complicated by fracture of the bones or not, are very likely to take an unfavourable course and end in amputation of the limb. The result in the case quoted was unusually successful, but in view of our previous experience great care was taken to ligature all the veins associated with the injured arteries. Case vii is included as an example of modern blood-vessel surgery. The case if left would have undoubtedly become an aneurysmal varix.

CASE I.

Pte. C. Admitted November 3rd, 1916, 10 p.m., with wound of right popliteal vessels.

On admission there was a wound perforating the calf trans-

versely at the lower part of the popliteal space. The calf was swollen and tense; no pulse at ankle; foot cold and white.

Operation (November 4th, 4 p.m.).—Popliteal space opened up in its whole extent through an internal incision. Remains of inner head of the gastrocnemius cut through. Damaged saphenous vein tied above and below. Both vessels found torn for about one inch. The popliteal vein was ligatured just above the entry of the short saphenous vein.

Result.—On November 5th the foot was warm, pink in colour, sensation present. The three following days gangrene threatened; the foot was purple and oedematous, but there was still some slow circulation. From the 9th to the 14th there was gradual improvement; the foot was pink again, though oedema persisted. The patient was evacuated on November 26th with the circulation apparently re-established in foot and leg.

January 1st, 1917. Letter from patient's brother: "Leg doing well, but patient very ill from septic poisoning."

January 20th. Amputation for sepsis in calf. Details supplied by officer commanding No. 3 A.G.H., Brighton. "Foot becoming white and bloodless."

CASE II.

Cpl. B. Admitted December 4th, 1916, 11 a.m., with wound of left popliteal vessels.

On admission there was a wound over the lower end of the posterior aspect of the thigh. Calf swollen; foot cold and pulseless.

Operation (2 p.m.).—Wound entering popliteal space; opened by dorsal incision. Both vessels torn; suture impossible owing to laceration; tied above and below. Wound drained and closed.

Result.—Uneventful convalescence. Condition of foot never gave rise to anxiety. No oedema. Sent down after three weeks; no pulse to be felt at ankle.

Three months later: "Foot in perfect condition."

CASE III.

Pte. L. Admitted December 13th, 1915, 1 p.m., with wound of superficial femoral vessels.

On admission there was a perforating wound $1\frac{1}{2}$ in. in diameter entering the back of the left thigh and coming out in front through the middle of Hunter's canal. A tourniquet had been applied, and the patient was almost dead.

Operation (2 p.m.).—Anterior wound opened up; both ends of superficial femoral artery and vein tied. Oozing from posterior wound—? profunda vessels.

Result.—Condition gradually improved after twelve hours' severe collapse. The wound became septic, but eventually cleared up. The foot was in a critical state for two days, then circulation improved. Patient sent away after three weeks with small gangrenous areas on tips of toes—like Raynaud's disease.

Letter from England six weeks later: "Foot the same."

CASE IV.

Pte. E. Admitted January 3rd, 1917, 8 a.m., with wound of superficial femoral vessels.

On admission there was a small perforating wound of the upper part of the left thigh, missing the femur. The wound of entry was on the outer side of the thigh; that of exit on the inner side over the femoral vessels. The thigh was greatly swollen; foot cold, and no tibial pulse could be felt.

Operation (January 4th, 11 a.m.).—Hunter's canal opened; clot removed; both superficial vessels tied. Too severely torn to suture. A handful of dark clot removed from interior of thigh. Outer wound slit up.

Result.—On January 15th there was no oedema of the foot—circulation returned in a few hours. No tibial pulse felt. Condition of foot never doubtful.

Letter one month later: "Foot quite healthy."

CASE V.

Pte. H. Admitted January 3rd, 1917, 8 a.m., with wound of the left femoral vein and thrombosis of artery.

On admission the foot was cold; no pulse at ankle. The entry wound was in the upper third, outer side, of the thigh, and the exit wound in the adductor region. A foreign body was found embedded in the opposite adductors.

Operation (January 4th, 12 noon).—The inner wound was widely opened up; dead stinking muscle was freely excised, including nearly all the adductor longus, parts of the pectineus and vastus medialis. The two ends of the superficial femoral vein were found torn across transversely, and sealed by clot, too far away to be united—tied off. The artery was found uninjured but thrombosed—a firm lump two inches above the apex of Scarpa's triangle, and no pulse in Hunter's canal. An incision, one third of an inch, was made into the artery and a small white granular clot squeezed out; from below, three inches of soft red clot was pressed out, like lanoline from a tube. The vessel was closed in the ordinary way, and the pulse returned to the vessel in Hunter's canal, although it was not felt in the foot.

Result.—Fourteenth day: Wounds very septic, but now cleaning up and granulating well. The condition of the foot had never giving rise to any anxiety. No pulse to be felt at ankle; slight oedema below malleoli. Twenty-first day: Slight secondary haemorrhage. Wound opened up; artery found thrombosed again. Circulation in foot good; slight oedema.

CASE VI.

Pte. G. Admitted February 13th, 1917, with compound fracture of right tibia; injury to peroneal and posterior tibial vessels.

On admission there was a penetrating wound of the leg; calf swollen and tense; no pulse in foot.

Operation (12 hours after injury).—Wound in calf freely opened up: peroneal artery on back of fibula torn—ligated together with vein. Haemorrhage persisting, the posterior tibial artery was exposed through attachment of soleus to tibia—found torn; artery and venae comites ligatured. A third incision was made in the calf to relieve tension. Carrel's tubes inserted; Thomas's knee splint applied.

Result.—Some oedema of foot, but perfect circulation. Patient doing well when last heard of.

CASE VII.

Pte. M. Admitted November 8th, 1916, with wound of right femoral vein and artery (partial).

On admission there was a perforating wound of the thigh over the line of the artery. Foot cold; faint dorsalis pedis pulse.

Operation (18 hours later).—Lateral tear in vein one inch long, sutured. Partial tear in artery—intima bulging like a small aneurysm—repaired by stitches, and fascial flap from roof of Hunter's canal sewn round.

Result.—Uneventful convalescence.

CONCLUSION.

Only a small series of cases has been brought forward, but the results are interesting. The experience of those who have ligatured the main artery alone will probably show that amputation has often to be resorted to, especially in popliteal cases.

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FURTHER REPORT ON THE EFFECTS OF HIGH EXPLOSIVES ON THE EAR.

BY

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I HAVE had under observation at the West Cliff Canadian Eye and Ear Hospital, during a period of four months, over one hundred cases of injury to the internal ear and its central connexion from high explosives. The chief symptoms are deafness and disturbance of equilibrium (dizziness, etc.). As these cases were first seen after an interval of several weeks or months, in order to observe the more recent effects of such explosives on the ear I was sent to France for six weeks. During this time I was stationed first at a Canadian casualty clearing station (Colonel Blanchard) and then at a Canadian stationary hospital (Colonel Davis). In addition to examining cases of injury to the ear at these stations I was permitted by the courtesy of the officers commanding to examine cases at adjacent casualty clearing stations and at a stationary hospital. The few cases of shell concussion deafness seen may be accounted for by the quietness then existing at these fronts.

The following applies to recent injuries (the cases seen at West Cliff will be dealt with in a subsequent paper). The majority were observed from twenty hours to a week after injury.

I saw over 200 cases exhibiting nerve symptoms ascribed to high explosives. Of these, 50 complained of deafness of varying degree. Of these 50, 17 showed demonstrable signs of injury to the internal ear traceable to the explosive. Of the others, the deafness in many had been temporary and no objective signs of disturbance of equilibrium could now be seen. The persisting defect of hearing was due in some to old middle-ear inflammation, in others to blockage of the external canal from wax or some other cause.

Of the 17 cases—7 had symptoms of nerve deafness without perforation of the membrana tympani, 10 had deafness with signs of recent perforation; 6 had definite middle-ear trouble previous to the concussion; of the other 11, with no previous history of ear trouble, 6 had recent perforation; 12 complained of vertigo and had observable signs due to it, the others had no complaints or symptoms of equilibrium disturbances.