often from 1 to 4 mm. in diameter, it generally becomes fast, cannot be reduced, and by dragging on the omentum causes symptoms which I should place thus in the order of their importance:

1. Pain or troublesome discomfort.
2. A feeling of dragging.
3. The ulcer syndrome, sour-stomach, occasional nausea, even vomiting, distress after eating, with periodic exacerbation of all symptoms, and even attacks of colic.

SIGNS

There is a bulging in the epigastrium, such as might result from the subcutaneous insertion of a small button. This mass occurs in these cases with symptoms of great tenderness on pressure, and is occasionally reducible; in that event, reappearing when the patient coughs.

Sharp pressure causes the patient to double up to escape the pain. In two or three instances, notably in one of a man with gastric ulcer, I found what I have called the "electric bell reaction." A touch on the hernia causes instantaneous belching—a quicker response than one would believe possible.

The definite association between epigastric hernia and gastric ulcer has long been known, but is not so widely recognized by internists as it should be. A patient receives no benefit from an operation for ulcer if such a tender hernia is overlooked. As I have elsewhere stated,³ the explanation probably lies in the long continued reflex irritation of the stomach by the omental "drag," so that hyperacidity and ulcer follow, as in chronic appendicitis.

REPORT OF CASES

J. H. S., a young soldier, was sent to the base hospital, Camp Logan, from the stockade, in which he had been confined for being absent without leave. He complained of constant indigestion, gas, pain, sour stomach and so much distress that he could not eat. He had been in another base hospital for the same trouble.

I found a very tender omentocoele 3 mm. in thickness and 1.5 cm. in diameter, and recommended immediate operation, believing it to be the seat of all his trouble. There were no signs of chronic appendicitis, ulcer or gallbladder disease. Three days after the operation the patient asked why the omentocoele had been overlooked at the previous hospital, "for," said he, "I now feel well for the first time in years. It was that constant, nagging pain that made me so cantankerous that I went absent without leave and, as a consequence, was put under arrest."

He was discharged well in a few days, with a recommendation that his sentence be suspended, as he was more of an invalid than a criminal.

In six similar cases, in only one of which did the sac contain part of the bowel, operation was performed here with perfect results. The surgeon who assisted in the first case was called as a witness in court to his former home. Learning that his associate had a patient with indigestion who failed to respond to any treatment, he examined him, found such a hernia, operated the next morning, and showed me a letter after he returned, stating that every symptom had disappeared by the fourth day.

Another young surgeon was ordered to a distant base hospital, and recognized such a hernia in a case of an officer at the time of his third admission for some acute abdominal disease, but was unable to convince the chief of medicine that the hernia was the cause of the trouble. On the fourth admission, a few weeks later, he talked so convincingly to the chief surgeon that the patient was operated on, and, what is more important, has remained absolutely free from symptoms ever since.

3. Hall, J. N.: *Borderline Diseases*, New York, Appleton & Co., 1915.

At his quarters in Houston, I saw a young officer with a violent attack of colic, his organization surgeon believing that he had a partial obstruction. His epigastric hernia was one of the most tender that I have ever palpated. He had been examined repeatedly in one of the most famous of eastern hospitals, with free use of the stomach tube and of the roentgen ray, but without definite diagnosis and, obviously, without any critical examination of the epigastrium. He is preparing to go to the hospital for operation at this time. The very fact that a two weeks' course of investigation, with every modern appliance, failed to show any organic digestive disease leads me to believe that his symptoms will all clear up with the operation.

I have just examined, in another hospital, a patient who has had his appendix removed and his gallbladder drained, with no benefit, and who has just such a tender hernia. This patient is to be operated on at once.

CONCLUSIONS

Physicians should examine with special care for epigastric hernia in every case of digestive disease. If a hernia is found, the opinion of a surgeon should be obtained as to the advisability of operation, unless it is clear that the hernia is without symptoms. These hernias are so minute and unobtrusive in many cases that we may safely say that the failure of the average physician to find them in possibly about 1 per cent. of the subjects examined is to be taken as evidence that the examination was made without sufficient care. Since less than a fourth of these hernias are associated with any digestive disorder, the question of operation arises in only a minority of cases; but it should, nevertheless, receive the most careful consideration. The surgical operation involved is trivial in comparison with the importance of the results commonly obtained.

HEMORRHAGE AND BLOOD TRANSFUSION IN THE WAR*

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Among the advances in medicine and surgery wrought in France during the war was the forcible demonstration of the great usefulness of blood transfusion; not only that, it was shown also that thus far nothing has been found to take the place of blood, once a hemorrhage has passed beyond the limits of safety.

This war development is of real significance for, despite efforts to popularize blood transfusion, despite all the brilliant advances of recent years made in this line of work and the reports of innumerable lives prolonged, and lives saved, by its use, there always existed in the profession generally an apathy toward it, a skepticism not only as to its efficacy, but also as to its need. How often have we been told that it is the rarest thing for a patient to bleed to death! The woman suffering from ruptured ectopic pregnancy never passes away from loss of blood—the bleeding gastric ulcer never bleeds till actual exitus. The torn blood vessel of a mangled limb always becomes twisted and plugged; so bleeding from it ceases. And after all, so we were told, a salt infusion or a gum infusion is all that is needed—urgent cases may, perhaps, demand the introduction of the solution

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by way of the veins. But, in either event, they will do all that blood will do.

Would that this were so! The number of American dead populating French cemeteries would be reduced quite considerably and the feeling of animosity toward those responsible for the ill-directed, albeit sincere, efforts to introduce gum solution into the treatment of hemorrhage and shock in the battle-wounded would be less keen. The theory was, as I understand it, that the solution of gum acacia possessed all the powers of salt solution for combating shock and refilling blood vessels emptied as a result of hemorrhage. But this was not all: It had a further advantage over salt solution—an advantage approximating even that of blood—namely, the power of sustaining a rise in blood pressure and of remaining within the confines of the blood vessels.

By way of explanation to those who perhaps are not familiar with the sedative degrees of efficacy of salt solution in blood it may be said that in cases of extreme hemorrhage and shock, while salt solution may relieve the condition, it has little sustaining power, chiefly because it rapidly passes out of the blood vessels into the surrounding tissues by osmosis. Blood, on the other hand, has real sustaining power because of its oxygen-carrying properties and its ability to remain intact as a circulating medium. It goes without saying that any medium possessing such attributes, and of a harmless nature—as was said to be true of gum solution—would have been of extreme, really untold, value in the treatment of wounded men. And it was quite in order to try it out. That the studies were, apparently, not carried out with an open mind, that overwhelming evidence against the solution was not sufficient to cause its abandonment, instead of promoting futile efforts to improve it, is greatly to be regretted. It would perhaps have been unfair to demand that when gum solution failed to measure up to expectation no effort should have been made to improve it—the probabilities are that Dr. Cannon and his co-workers felt that the medium had so much to commend it that further efforts were justified. I can only say that with its initial fall from grace, there arose a fear of it and a prejudice against it of such widespread proportions that it never had a chance afterward. Besides, we were at war, our troops were engaged in actual battle, the wounded were coming in by the hundreds and thousands: this was no time for further experimentation. All the efforts of the shock teams, surgeons, physicians and nurses should have been concentrated on salt solution and blood transfusion, the efficacy and the limitations of which we already knew. It is my opinion that if one-half the energy and time that were spent on gum solution had been spent on efforts to get blood and secure donors, we would have more to show for our efforts. Salt solution was practically always at hand—I say practically, because the strain and the stress were so great, at times, that even this simple remedy was not to be had; so we needed, chiefly, a more intensive effort to secure blood—to be used only in those cases in which salt failed to help.

When my attention was called to the fact that patients who had been given gum solution were failing to react, that in certain instances the blood pressure not only failed to show the expected rise, but actually fell, that the fluttering pulse failed to steady and that the depression even had a tendency to become more

alarming than it already was, I suggested, when my advice was asked, that salt solution be given instead of the gum, and that more intensive efforts be directed toward securing blood for those most in need of help. The results were gratifying. It was possible to secure blood oftener than one would imagine, and not from the hospital personnel, either. I am opposed to using these self-sacrificing, overworked persons, even when they volunteer. Passing troops, billeted troops, the lightly wounded, patients with fracture, gave willingly of their blood.

Even so, the number of lives thus saved, compared with the number that might have been saved, was small—and all because blood in bulk was not obtainable, and salt solution, in many cases, would not answer the purpose. I am confident that the high mortality in certain types of cases would have been reduced materially had it been possible to give the patients even small quantities of blood. This is particularly true in the case of those compound, comminuted fractures of the femur in which the patient came in severely shocked by loss of blood, pain, hunger, fatigue and delay in getting him back to the base. The splints were usually properly applied. Salt solution overcame the shock; but because too much had been expected of it, and because blood was unavailable, results were too often fatal in spite of immediate operation.

I recall the case of that man who came in almost lifeless, his left femur shattered in its lower third by a through and through shell fragment. For twenty-four hours he hung between life and death, but as the result of the most judicious use of salt infusions he gradually picked up until operation was considered feasible. A further delay of twelve hours would have been better, but he began to show definite signs of gas infection, and it was then or never if an operation was to be performed. He died eighteen hours after it. If we could have given him 400 c.c. of blood during the operation, he would surely have survived.

I could cite numbers of cases like the one just mentioned, but there is little to be gained thereby. We came to fear this type of case more than others. At times it was impossible to delay operation a moment, owing to the fulminating gas infection which was so prone to develop. Salt solution to the extent of 500 or 1,000 c.c. would be given in the shock tent, a bit of heat applied, and the operation performed. When we had blood, it was customary to give it just as the operation started, in order to tide the patient over; and those who received it invariably did better than those who did not. A case in point is that of a sergeant who came in with an arm shattered, a leg hopelessly injured, and his remaining hand badly torn, one of the most battered-up men it has ever been my pleasure to see live. He too was worked over for twelve hours, at the end of which time some blood was given him. He was put under a light ether anesthesia, and one surgical team removed the arm while another took off the leg. A few days later he had to be put to sleep again to have his right hand cleaned out, his condition at the primary operation having been such that it had to be left untouched.

Another case has always stood out in my mind: A very young trooper was brought in—the instances I am citing occurred during the second battle of the Marne—with his left leg hanging by some loose tissue, the whole wound area filled with dirt and grass and

creating a strong suspicion of a gas infection. His condition was so critical that a member of the shock team attached to our outfit, seeing him lifted out of the ambulance and recognizing the urgency of aid, had him carried directly to the operating room. Any kind of operation then would have meant death; so while he was being given 500 c.c. of blood, which were, fortunately, obtainable, I simply removed the foot with one stroke of the knife and put on a bandage—trusting to luck concerning later developments.

It was remarkable how that boy picked up. Within a few hours, aided by hot water bottles and some hot drinks, he had taken a new lease on life. Nor did he slip back in the slightest—even when, twenty-four hours later, the signs of gas infection were unmistakable. He withstood an amputation above the knee without a quiver and, a few days later, was evacuated to the rear, a well, happy boy, smoking the inevitable cigaret. I could cite other instances like this one, equally gratifying; but one example is as good as a dozen in the same class of cases.

So much, then, for the acute hemorrhage and shock of the battle casualties. The need for blood was great and urgent; the supply, pitifully small. Substitutes were tried and found wanting. Further to the rear, where conditions were a bit less strenuous than in the forward areas, it was possible to secure blood more often, and in greater quantities. Thus, in the base hospitals, a great light was shed on the value of blood transfusion in the anemias secondary to battle wounds. These were very common and most distressing. The men would lie pale, inert, unable to eat, nervous, day by day slipping back just a little, while their wounds not only failed to heal but became increasingly dirty, until all bodily resistance being finally overcome, septicemia ensued, and death resulted. Particularly was this true of bone and joint cases.

We transfused a number of these men, and in nearly every instance a prompt improvement followed. One of them had a huge wound of the buttocks with a great area of bone involvement—always a sad condition. He was having rough going until he got some blood, after which his improvement was rapid and continuous. Another man had a big thigh wound and a septicemia—staphylococcus, I think. He overcame the septicemia, as many did, but his anemia was so profound that he did not improve. With two or three doses of blood, however, he took on renewed life and finally recovered, though the leg had finally to be removed. Still a third, and a most remarkable demonstration of the efficacy of blood transfusion, was that of a young lieutenant of aviation who, being wounded through the chest, crashed to earth, sustaining a compound fracture of both bones of his right forearm, a similar condition of the bones of his left lower leg, and a compound fracture of the bones of his right foot. Two months later, when I saw him, he was a mere skeleton, and, in addition to his fractures, had three intractable bedsores and a knee joint involved in a metastatic infection necessitating the turning back of the patella. It was clearly a case of too much absorption from too many foci of infection. In all, this man received four transfusions. After the second, his right leg was removed just above the knee for, with the foot hopelessly crippled and the knee joint badly infected, it was simply pulling him down without offering him anything in case of his recovery. The last two started him on the road to

recovery. He was far from a well man even when he reached America; but without those transfusions his chances for life would have been nil. These three cases, each one of a different type, are sufficiently illustrative to prove the efficacy of blood in aiding the recovery of the battle-wounded.

At my suggestion, the sodium citrate method was adopted by the Medical Department of the American Expeditionary Forces as the only method of blood transfusion to be used. The reasons for this are so obvious as hardly to need explanation. Its simplicity, its elasticity, the fact that it could be employed under circumstances that precluded the use of any other method, all combined to make it the one procedure of election. At my further suggestion, all transfusion work in France was turned over to the medical men. Thus it happens that many men have obtained a wide experience in blood transfusion who, in civil life, had had no opportunity to familiarize themselves with it. A brilliant page in the history of blood transfusion was written in France. Let the physicians who wrote it there expand the chapter here.

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THE COURSE OF EVENTS IN SECONDARY WOUND SHOCK *

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In the issues of *THE JOURNAL* of February 23 and March 2, 1918, there was published a series of articles by Cowell, Fraser, Hooper and myself which described certain clinical observations that we had made on soldiers who suffered from shock and allied conditions. These observations confirmed earlier reports on the persistent low arterial pressure, the rapid pulse and respiration, and the lowered body temperature of the shock state; they also revealed a concentration of corpuscles in the capillaries, a reduction of the alkali reserve corresponding in general to the degree of lowering of arterial pressure, a marked sensitiveness to ether or chloroform anesthesia, and a tolerance of nitrous oxid and oxygen as an anesthetic. On the basis of these facts a definition of traumatic or wound shock might be offered; it is a general bodily state occurring after severe injury and characterized by persistent low arterial pressure, rapid pulse, pallor or slight cyanosis, sweating, superficial rapid respiration, and usually by a dulled mental condition.

EXEMIA AS A CAUSE OF LOW PRESSURE

Among the articles in the series above mentioned was a theoretical discussion of the nature of wound shock, in which the low blood pressure was regarded as the central fact of the fully developed complex.¹ Reasons were given for refusing acceptance of the acapnia theory and the nerve exhaustion theory of the low pressure. The factors determining arterial tension were then analyzed, with the result that the low pressure was ascribed to "exemia"; that is, a

* Read before the Section on Surgery, General and Abdominal, at the Seventieth Annual Session of the American Medical Association, Atlantic City, N. J., June, 1919.

1. Cannon, W. B.: A Consideration of the Nature of Wound Shock, *J. A. M. A.* 70: 611 (March 2) 1918.