THE
Hastings Prize Essay,
 1866.

ON
**SHOCK AFTER SURGICAL OPERATIONS
 AND INJURIES.***

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THE SPHYGMOGRAPH IN SHOCK.

THERE can be no doubt that while in shock, as a rule with very few exceptions, the impression of a severe injury is made first on the nervous system, most of the more marked phenomena are due to the secondary effects of the injury on the heart, and consequently on the circulation generally. Indeed, the degree of enfeeblement of the action of the heart will serve as a fair index of the reduction of vitality generally. It cannot, further, be denied that the sphygmograph, as perfected by M. Marey, gives the only certain mode of estimating the degree of enfeeblement, or, indeed, of any other change in the heart's action.

The character of the pulse is affected by several conditions, which affect its character and modify the trace written by the sphygmograph on paper. These conditions are, the propulsive power of the heart, the degree of rigidity of the arterial walls, and the facility with which the blood is propelled through the capillaries. In shock, the degree of propulsive power of the heart will be indicated by the length of the line of ascent, which commences the trace of a single cardiac impulse. It is obvious, however, that where the arterial walls are maintained in a state of tension by any difficulty in the passage of the blood through the capillaries, the ascent of the trace will be correspondingly shortened, and the line of descent also will be made more or less irregularly convex. In experiments which have been made at my request, to illustrate certain questions in the consideration of shock, it was found that in certain injuries, or even under mental emotion, the capillary circulation was arrested in the frog's foot, together with the circulation in the larger vessels. When reaction occurred, it was found, in the more severe injuries, that for some time the blood only circulated in the larger trunks as far as the capillaries. In shock, the impaired circulation in the capillaries is no doubt due mainly to the weakened propulsive power of the heart. That it is so altogether, is doubtful. The coldness which is present in shock probably leads to contraction of the smaller vessels and capillaries. But, although the capillary circulation is impeded, there can be little doubt that the feebleness of the heart's action prevents any considerable approach to a state of tension in the arteries.

The second pulse-trace given below was taken

from a man whose thigh had been amputated half an hour previously. The shock was not severe, and was already becoming less intense, while the nervous system was extremely unimpressible.

With further trials, I do not doubt that I shall be able to obtain the written character of the pulse in every stage and condition of shock.

In a case of shock where the pulse is sufficiently detectable to act on the lever of the sphygmograph, the elevation of the line of ascent may be fairly taken as an indication of the force of the heart's action, and as an index of the intensity of the shock.

The sphygmographic tracings here represented are selected from those taken before operation, shortly after, and also from those taken during reaction.

The first trace was taken half an hour before the operation of amputation of the thigh. It presents some irregularity, especially in the diastole, and illustrates that slight degree (in this case very slight, for the patient was remarkably free from the excitable, emotional, nervous temperament) of shock from the operation of psychical causes which is likely to be present half an hour before an important operation.

The second trace was taken one hour and twenty minutes after the operation—a little too late to represent the greatest severity of the shock. The much shorter ascent of the lever, as represented, shows very forcibly the diminished propulsive power of the heart; but it also shows greater regularity, as well as feebler action of the heart. This unexpected peculiarity may perhaps be attributed to the diminished influence of mental causes, due partly to the shock to the nervous system, and partly to the still lingering effects of chloroform. There is also less concavity in the general descent of the trace, which is most probably caused by the impeded transmission of the blood through the capillaries, which, as the experiments I have to bring forward will show, is prone to occur in shock. It may also be partly due to the fact that, in consequence of the removal of a large part of the body, there is relatively more blood in the vessels.

The following trace was taken for me by my friend and colleague Dr. Foster, on the morning of the second day. The difference between this and

the last is very noticeable, not so much in the line of ascent, which is only slightly higher, but in the roundness of the junction of the ascending and descending lines, and still more so in the greater distinctness of the diastole, which forms a distinct second elevation, and which is very characteristic of fever.

* Continued from page 167 of JOURNAL for Feb. 16th.

The following trace was taken on the third day after the operation.

In order to show the value of the dicrotism as an indication of fever, I give here a trace of the fever of pyæmia, kindly furnished to me by Dr. Foster. The extreme character of the dicrotism is strikingly manifest, as the lever of the sphygmograph descends as low just before as it does immediately after the dicrotic elevation.

It is not necessary for me to dwell on the advantages to be derived from the use of the sphygmograph in medicine and surgery. Physiologists have already recognised it as the only mode of estimating the character of the pulse which is not open to doubt. The impression made on the finger by the pulse is so much less certain and decisive, that opinions formed on this basis possess only a relative value. If six able and experienced physicians were to feel any given pulse, and were invited to write a description of it, they would give six accounts, not two of which would closely resemble each other. The sphygmograph alone gives a description clear, accurate, and beyond dispute. The importance, then, of obtaining the sphygmographic characters of the pulse in every deviation from health is too obvious to require comment. The trace which I have given of the pulse in shock is peculiar, and differs from any other condition of the pulse. The last trace is one taken from the same patient from which the four first traces were taken, a month after the operation. It is a good illustration of a healthy pulse.

I give here traces of a few other cases, with brief comments.

This trace was taken half an hour before amputation below the knee. The roundness of the junction of the lines of ascent and descent denotes an atheromatous state of the arteries. The next trace

was taken in the same case under the influence of chloroform. It is of extreme interest, from the increased length of the line of ascent, caused partly by diminished tension of the walls of the vessels, and partly, no doubt, to the increased propulsive power

of the heart—a fact quite opposed to the popular view of the effect of chloroform.

The preceding three short traces were taken with difficulty on the operating table in the same case. The first was taken immediately before the application of the saw, the second during the action of the saw, and the third immediately after the bone was divided. The latter two exhibit marked shock from the action of the saw.

Two or three minutes later, the above was taken, which shows that the heart had already acquired greater strength of action. The two succeeding

traces were taken, one five minutes later, and the other ten minutes later. Both show how rapidly reaction occurs in the heart and circulation.

The above trace was taken on the morning of the second day, when reaction had set in. The traces of the above case were kindly taken by Dr. Foster; those taken on the operating-table were, for obvious reasons, obtained with difficulty.

The two following traces were taken from a case of excision of the breast. The first was taken two hours before and the second five hours after the operation.

[To be continued.]

CENTENARIANS IN FRANCE. No less than twenty centenarians died in France during the year 1866. The eldest, Rabbi Frank of Tourville, was 108 years old. Three other persons attained the age of 107, two 106, two 105, two 102, and two 101. The remaining five were some months over their 100th year. At Vienna, M. Stamer, president of Austrian mines, died at the age of 118. At Ilemön, a Spaniard named Pedro also attained the age of 115; and at Alilla, in Mexico, Senor Orifro Roblez reached the term of 133 years.