of a vessel. For this purpose, we may employ an instrument founded on the use of the tubes of pitch, of which engineers avail themselves to measure the rapidity of watercourses. This instrument, by means of a special arrangement, allows the transmission to a distance of the movement which expresses the different rapidity of the currents of the blood; and, as the physiologist is already in possession of instruments which inscribe the arterial pressure by combining the two orders of tracings, we obtain precious information concerning the state of the arterial circulation. Although this kind of study, which is especially physiological, has not yet, to speak accurately, its medical applications, it deserves to attract our attention for a moment.

It may be said that, up to this time, the conditions of the arterial circulation have been incompletely determined; the employment of the manometer becoming extended in physiology permits us, it is true, to ascertain if the pressure rise in the arteries, or if it fall. But on what does this change depend? Is it due to a modification of pressure arising in the force of the heart? or to a change in the diameter of the small vessels, which allows the blood to pass more or less rapidly from the arteries to the veins? This question the manometer alone cannot solve.

A familiar illustration will well explain the difficulty which is offered by the interpretation of the changes of arterial pressure. If we learn that the level of a river is raised, we cannot from that information alone learn if the increase be produced by abundant rains which have passed more water into the river, or if it be the effect of a barrier placed across the current of the stream. To judge of what has happened, we must know further if the current have become more rapid, or if it have slackened. A *simultaneous* increase in the rapidity and the height of the water indicates a more considerable afflux; but, if the increase be accompanied by a slackening of the current, it is due to a barrier existing *en avant*.

The conditions are the same in the circulation of the arterial blood; here the pressure of the blood corresponds to the height of the level. The changes of pressure alone do not suffice to determine the state of the circulation. But, if we know at once the rapidity and the pressure of the blood, we have all the elements of the solution of the problem. When the double tracing shows that the rapidity and the pressure have varied alike, it is to a change in the force of the heart that we must look for the cause of this double variation; but, if the pressure and the rapidity vary inversely to each other, it is in the small vessels that we must look for the cause of the change.

Fig. 11 shows a double tracing of the rapidity and of the pressure; we see there that the curve of speed is depressed, while that of pressure is raised. It is, then, an obstacle to the flow of the blood which has occurred in this case.

Another application of the graphic method of the study of the movements of the blood consists in inscribing the movements of the waves which the heart sends into the arteries. These waves, entirely subject to the laws of hydraulics, traverse the interior of the vessels, passing from the heart to the extremities. According to the rapidity of their progress, and according to the space over which they have to pass, the pulse of an artery is more or less behind the systole of the heart which produces it. The knowledge of these movements of the blood-wave is indispensable for the theory of the dicrotic pulse, in which the double beat which the finger ascertains corresponds to the two successive waves which flow one after the other to the interior of the vessel.

To follow the movement of the waves to the interior of an artery or of an elastic tube filled with fluid, we arrange along the course of the vessel or of an elastic tube filled with fluid a series of exploratory instruments analogous to those already described. Each of these corresponds to a writing lever, and the series of levers is placed as usual, so that the pens may be exactly superposed. In passing under each instrument, the wave produces an elevation of the corresponding lever. Then we see the levers begin to move one after the other, and to trace a series of curves of which the interval of succession allows the exact measurement of the rapidity of the wave. When each of the levers experiences a series of successive oscillations of decreasing intensity, it is because a series of waves has been produced as the sequel of a single penetration of fluid into the tube. Such is the phenomenon which gives rise to the dicrotic pulse.

But I have insisted perhaps too much, in this limited address, on the application of the graphic method to the study of the circulation. My object was to show that almost all the movements of the blood may be inscribed, and consequently measured, with extreme precision. If I have attained this object, allow me to pass to other applications of the method, and to approach other movements not less important for the physiologist and the physician to know and to understand.

FURTHER OBSERVATIONS ON HARE-LIP AND CLEFT PALATE.

By SIR WILLIAM FERGUSSON, Bart., F.R.S.,
Surgeon to King's College Hospital, etc.*

In April 1874, my experience of the supposed new operation extended to only three or four cases. It seemed to me so likely to be of service in cases which I had abandoned in despair, that I felt it a duty as well as a pleasure to let my professional brethren know as much as I could communicate at that early date. The number in which I have now had similar experience amounts in all to eighty-two. This experience is larger than I could have anticipated in less than twenty months' time, but it may be considered the more valuable on that account, both as regards numbers and freshness of work. The results have been such as to induce me to consider the process which I recommend as a vast addition to our surgical resources in this special department. In the above number (eighty-two) fifty-six are cases treated for the first time; the remainder are instances where further manipulative interference has been required, including examples of holes, large or small, in the hard palate, which I had left as beyond help from surgery excepting by means of an obturator, associated with defect of teeth in front. In two of these, I consider the proceeding to have entirely failed. In these, each patient was only four years of age, delicate, and with a wide gap. Although mechanical approximation in the middle was satisfactory, union by the first intention failed. Inflammation seemed greater than could be desired, and slight necrosis took place in each, so that the gap was left even wider than before. In several instances, particularly in the early operation before precision in the use of the chisel had been acquired, one or possibly two small pieces of bone came away necrosed; but, considering how the chisel has been freely used in some of these cases, I have been astonished how little damage has been done to bone. In some instances, union failed both in hard and soft parts from unaccountable causes, just as happens, from time to time, when the soft palate alone is involved; this is seen sometimes even in favourable cases of hare-lip, but my success has been such that I feel great confidence in the successful result of almost every instance of well-performed operations of the sort. Where holes and slits have been left either in hard or soft palates, or where union has been defective in the uvula, such defects have usually been amended at one or more subsequent operations, to which patients have readily submitted, owing to former immunity from pain under chloroform.

In one instance, an attack of scarlatina thwarted my best efforts; and in another, unhealthy inflammation arose after three operations, and ulceration marred, in some respects, the completeness of the proceedings.

The cases in the hard palate, which have given me most trouble, have been where the vomer has been extensively attached to one side. In most of such cases the vomer diverges to one side. The palate can here be as readily split as if no vomer were present, but two objects of the splitting cannot be obtained; the margin of the palate can scarcely be drawn towards the middle, and the flap cannot be brought downwards to meet its more movable fellow. This has been a cause of failure which I did not at first appreciate; but subsequently I have achieved success by chiselling on one side, and paring off the soft tissue from the hard palate, on the side where the vomer was, and stitching it to the more substantial flap on the other side, thereby combining the new and old processes, with benefit to the patient, and some additional credit to our surgical resources in this locality.

Mr. Mac Cormac has most obligingly laid before me most of the German authorities on the subject. Although Dieffenbach suggested the operation in 1826, no case of his has been recorded. It seems to have been put into execution for the first time in 1834, by Bonn, with success. Langenbeck, from 1849 to 1856, operated in three cases, but definitively abandoned this proceeding. Two cases of openings in the hard palate, from syphilis, have been operated on by Bühring on similar principles, but unsuccessfully. Between 1826 and 1856, some half-dozen cases have been recorded by German authorities, in which the hard palate seems have been cut by saw, knife, and chisel; but altogether the circumstances may be considered so different from those which I have described within the last twenty months, that there is but little resemblance between them. Muscular action, particularly that of the levatores palati, is not even referred to; the use of anæsthesia or a gag

* Concluded from page 773 of number for December 25th, 1875.

is not alluded to in any of them, nor is the attitude of the patients— which I consider a great element in modern staphyloraphy.

Here, however, is what I contend for in support of my paper of April 4th, 1874, in bringing forward fifty-six original cases operated on, chiefly in accordance with the views therein propounded since that time, all of which, with a few exceptions above referred to, have been successful. In a considerable number of these cases, further operations have been required, and many of these were of a kind which, under former views, admitted of no remedy, excepting by artificial plates. The further interference in these cases has been such as to induce my assistant and registrar Mr. Rose to put down each as an operation; because, in each such instance, chloroform has been used, and the whole manipulative process on the hard palate has been in a manner repeated. Edges have had to be made new again, stitches introduced, and chisel applied. My reasons for stating that the circumstances of twenty or forty years back are different are that, in former times, as far as I can understand, the patients were seated upright; now, in my practice, they lie on a table; then there were neither gag nor chloroform, and in these I am of opinion that much of our modern improvement in practice consists. In my former paper, I had pleasure in according to my friend Mr. Thomas Smith, of St. Bartholomew's, the merit of introducing the use of chloroform and the gag in these operations; and I feel further bound to repeat my admiration for his forward movement in regard to these almost essential adjuncts.

Experience has led me to make some modifications in practice formerly described, which I fancy worthy of the object of this present paper. In dealing with a cleft in soft and hard palate, I still adhere to my preliminary division of the levator palati on each side; but if from the size of the gap in the hard palate it be deemed needful to introduce one, two, or more stitches, I advise that the holes for them be bored with the bradawl, and that the stitches be introduced before the chisel is applied. I think it an advantage, too, to make the edges of the gap bare before loosening the portions of the palate with the chisel. If these parts be made loose first, it is very difficult to push a bradawl or needle through, and there is great risk of one or both slipping, so as to separate periosteum from bone and endanger the occurrence of necrosis. This I believe to have been the cause of the misfortune in the two cases above referred to, when the operations signally failed. But I fancy I have further modifications and improvement to impart here. Recent experience has led me to the fact that stitches may not be necessary in many instances of cleft in the hard palate. I have found again and again that, when the edges of the gap have been pared and the chisel introduced, it answers to cause approximation of the raw margins by stopping the opening made on the hard substance by the chisel, with lint, so as to make the desired closure in the centre. The pledgets of lint keep the parts as steady as, if not more so, than the stitches, whilst they obviate the necessity of the additional injury of the stitch-punctures. This practice, I am confident, is available in all instances when the opening in the bones is of brief extent, as the front stitch in the soft palate may be put in close behind the posterior margin of the bones.

In my former paper I referred to gags, and particularly to those of Mr. T. Smith and Mr. Wood. For various reasons, which need not be dwelt on here, I have set these aside in favour of a more simple apparatus, chiefly suggested by my friend Mr. Mason of St. Thomas's, and in a manner perfected by Messrs. Matthews, instrument-makers in Carey Street, which I strongly recommend as the best I have yet seen for the operation in question. In fact, I consider the gag as an essential instrument for the modern proceeding, for without it chloroform would be worthless. This sketch shows the instrument in question.

The narrow blades are introduced shut between the teeth on either side the surgeon chooses, and are opened by pressure on the handles at the will of the assistant who holds them. The power of the instrument is such that, if care be not taken, the lower jaw may actually be luxated, as I have seen more than once, although happily with no permanent evil. There is a peculiar twist in the blades of this instrument as regards the cheek and margin of the mouth, which can be better appreciated by looking at them in action, than from any description that might be given here. The length of the whole instrument is about

seven inches, and it will be useful to have two, one slighter than the other, to suit the mouths of patients from four to ten years of age. This gag will be found of much value in many operations about the mouth and tongue, and I presume to say that it will prove a valuable aid to the dentist.

On thinking over all that I know of these matters, and especially as regards my own humble work, I am impressed with the slowness with which facts and improvements have come upon my mental conception. I believe that I was the first who dissected and described the anatomy and physiology of cleft palate (cleft, be it observed), yet five years or more passed before the simple mechanical value of the information thereby obtained dawned on my mind. Neither the action of the levators in tugging upon the stitches, nor that of the superior constrictors of the palate in closing the cleft during deglutition, were thought of; but happily, when tenotomy and myotomy were in the full swing of novelty and fashion, I bethought me of my old dissection, which, having been fortunately preserved as unique, gave me the opportunity of further study and reflection. Yet, even now, after a comparative calm in my own mind, I am amazed at the slowness with which point after point has gradually come upon me in an experience of between three and four hundred operations, including old fashioned and new. These latter observations have been more impressed on my mind within the last two years than at any previous date.

CLINICAL LECTURE

ON

THE ADMINISTRATION OF CHLOROFORM.

Delivered on November 23rd, 1875.

By GEORGE H. B. MACLEOD, F.R.S.E.,

Regius Professor of Surgery in the University of Glasgow; Surgeon to and Lecturer on Clinical Surgery at the Western Infirmary; etc.

GENTLEMEN,—One of the first subjects on which I desire to give you instruction is how to administer chloroform, as in my service this duty is devolved on the dressers, and is not confined to a select body or a special individual. I cannot, of course, ask you to undertake this work till you have been carefully and minutely instructed thereon. To-day, I wish to explain the chief points which demand attention, while frequently I will have an opportunity of practically demonstrating to you the application of each rule I give you; till, in a short time, I will depute you (but always under my immediate and close supervision) to administer the anæsthetic when occasion arises. The duty to which I allude is a very delicate and anxious one to all who know the dangers which may arise; and it is because I consider it a very important part of your clinical education to be able successfully to perform it, that I take upon myself the additional anxiety and responsibility of allowing you to concern yourselves at all in the matter. It is an important privilege to be allowed to gain personal experience regarding this very potent agent; but, that it be not abused, your most careful and minute attention is demanded. When you go into practice, you must frequently have recourse to an anæsthetic, if you do not wish to divest yourselves of one of our most useful therapeutic appliances; and my object is to prepare you to use that agent which, in Scotland, we almost exclusively employ—viz., chloroform—with the freedom and boldness which is founded on a due knowledge of its power and its dangers, and not on the rashness which arises from ignorance. It is one thing to see it administered by another, and a totally different affair to be clothed with the responsibility of giving it yourselves; so that while I look on and see that nothing is omitted or done amiss, yet you will have in your own hands (after these demonstrations) the actual administration of the chloroform. It is only thus that you can come thoroughly to be prepared to use it in after-years. I beg of you clearly to understand that, when you take upon yourselves to give chloroform to a patient, you assume a very great responsibility. It is not a thing lightly to be determined on, or to be carelessly carried out. Every time it is administered, a certain menace is directed against the life of a fellow creature; and it is only by the utmost attention to certain rules that safety is secured. By the proper use of chloroform, you can accomplish very important ends. Much can be attained of comfort and safety for your patient, as well as of satisfaction and security for yourselves. But if any one proceed to use this agent without due attention and knowledge, he may in a moment meet with a catastrophe so serious as to destroy his happiness, if not also his prospects for life.