SURGICAL CLINIQUE.

LECTURE ON THE PREVENTION OF LOSS OF BLOOD DURING OPERATIONS.

By Professor F. Esmarch, of Kiel.

[CONCLUDED.]

If we now cast a glance at the history of the development of our plan, you will become acquainted with the fact, that the endeavours to restrain the loss of blood during operations as much as possible, are as old as surgery itself. They have, in many instances, impressed their characters on its different periods. If in the olden time amputation was performed with red-hot knives, or the stumps were dipped in melted pitch after the operation, the object was to obtain the mastery over the bleeding, because no other way of stopping it was known. It was when the idea of preventing hæmorrhage by ligature of the vessels occurred to Ambroise Paré that for the first time surgery assumed a less repulsive character. This surgeon taught at the same time how to restrain the flow of blood by compressing the limb above the place of amputation, and thus gave the impulse to the numerous methods of arterial compression, and to the multitude of apparatus by which we endeavour to restrain the loss of blood in amputation. That all these methods and apparatus are imperfect, appears most plainly from the fact that no method has gained for itself an exclusive pre-eminence, and that new tourniquets have been constantly devised and recommended, of which, however, not one in recent times has even come into general use among surgeons. I, at least, when a student, did not see a single amputation performed with the help of a tourniquet. My teachers preferred to have the main artery of the limb compressed with the finger; this was just as safe as the tourniquet, and it moreover gave the students and assistants a desirable opportunity of exercising themselves in the restraint of hæmorrhage. The use of the tourniquet had completely gone out of fashion, although in many instances the patients lost a great deal of blood, especially when the operation was of rather long duration.

For some time, surgeons sought their reputation in performing amputations as rapidly as possible. One of the quickest operators of his time was the old C. J. M. Langenbeck, of Göttingen. He knew how to cut off a leg or an arm by his oval method with incredible rapidity. When I studied at Göttingen, an anecdote was told me about him, which furnishes a striking example of this. A celebrated old surgeon once came to Göttingen, to be a witness of one of his rapid operations; and Langenbeck promised him that he would perform disarticulation of the humerus by his method. When the operation was about to begin, the old gentleman turned round to take a pinch of snuff; but when he again turned himself, the operation, to his sorrow, was finished. His celebrated nephew, Bernhard von Langenbeck, while general staff-surgeon of our army in Schleswig-Holstein, in 1848, threw the foreign military surgeons into amazement by the rapidity with which he performed his amputations.

This acceleration of the speed of operating arose also in part from the desire to cause the patients as little pain as possible; and since this object has been much more completely gained by the use of anæsthetics, the same value is not attached to rapidity of operation as formerly.

To me it has always seemed an especially important duty of the surgeon, to deal with the "most noble juices" of the patients entrusted to us as economically as possible; and therefore since 1855, I have always firmly enveloped limbs intended for amputation in linen bandages, so as to press out as much as possible of the blood circulating in them. This was suggested to me by an amputation of the thigh, which I removed on account of a large osteo-sorcoma. When I proceeded to examine the leg that had been removed I was horrified at the large quantity of blood which still flowed from its vessels; and I said to myself, that in future this blood must be saved. I remembered an operation, in which I had some years previously assisted my predecessor Stromeyer. It was a ligature of the brachial artery for aneurism, in which Stromeyer, in order to limit the storage of blood in the capillaries, bandaged the arm as high as the aneurism before he applied the tourniquet. We had much discussion at the time on the interesting fact, that the blood pressed out of the capillaries into the arteries showed the dark colour of venous blood; and were astonished at the ease with which the brachial artery could be tied after all the blood yet present in the arm had escaped through the incision. No further inferences with regard to other operations were at the time drawn from this observation either by Stromeyer or myself; but I now applied the idea to amputations and disarticulations, and have since always practised the method, when I have had the opportunity, to save as much as possible of the blood of a patient on whom amputation was to be performed. I have shown it to many surgeons in my hospital practice, and especially in the various wars in which I have acted as consulting surgeon: and during my service in the Berlin barrack hospitals in 1870 and 1871, I made the surgeons, whose adviser I was, carefully bandage the limb before every amputation. In this way, and with the help of the aorta-compressor, I have even been able to perform disarticulation at the hip-joint with very little loss of blood; but still the result was always incomplete, partly because I bandaged the limb only as far as the diseased pert, or at most as far as the place of amputation, and especially because I applied digital compression only to the main artery. In such cases, where anatomical conditions had to be dealt with, and where everything depended on not allowing much blood to be lost, I sought safety in operating as rapidly as possible. Thus, in many cases, in operating by the circular incision, which is the quickest way in which amputation can be performed, I have first divided all the soft parts down to the bone with one cut, and have then rapidly sawn through the bone at the level of the incision and tied the vessels. When the hæmorrhage was arrested, I have then stripped back the periosteum from the bone, and sawn off an additional piece some inches long. Again, in performing disarticulation of the femur, I have endeavoured to reduce the loss of blood to a minimum, by tying *en bloc* the femoral vessels in the anterior flap, making a circular cut through the muscles, and quickly sawing through the bone at the level of this incision. The vessels were now all tied singly, and when this was done, the head of the bone was disarticulated. In one such case, I injected into the femoral vein the blood poured out during the operation, having first defibrinised it.

But in desperate cases all these measures fail; the loss of blood is always greater than the enfeebled system can bear, and hence the complete occlusion of the blood from the parts to be operated on becomes desirable. In the expiration of vascular nævi, involving the whole thickness of the cheek, Dieffenbach recommended a proceeding which is capable at least of preventing the access of blood until the ligature is applied. He used a forceps, the blades of which ended in oval rings, between which the tumour to be removed was firmly compressed. In a similar way act the compression-forceps contrived by Desmarres and Snellen for the extirpation of tumours from the eyelids, which may also be very well employed in operations on the lips. In the extirpation of nævi, I myself use rings of horn or tin, which are firmly pressed round the tumour by the assistants' fingers and almost completely prevent the influx of blood, especially where there is a hard base, as on the cranial bones. The discovery of a similar proceeding applicable also to the greater operations appeared to me for a long time a profitable task.

The numerous and successful applications of india-rubber in surgery readily suggested that its elasticity might be of use for our purpose; and it has proved efficient beyond all expectation. After a few experiments had made it certain that the circulation could quite easily be interrupted by means of an ordinary caoutchouc tube, the proceeding now under consideration was rapidly developed.

A piece of tubing, such as is used for making counter-extension in the treatment of diseased joints by weights, first served as a tourniquet; and one of the india-rubber bandages, with which we can so rapidly remove serous effusions in the knee-joint, was used for enveloping the limb. Each experiment which I made with the new method demonstrated its advantages more and more. One improvement after another was found out. An experimental study of the physical conditions was undertaken by one of your fellow students (Dr. Iversen, in his inaugeral dissertation, *On Artificial Ischæmia in Operations*, Kiel, 1873); and the more I became convinced of the proceeding, the more lively was my desire to extend it to as many operations as possible. Unfortunately, their range is limited. We can be complete masters of the circulation only in the extremities, and in the external genital organs of the male.

Perhaps, however, the tubing might be made useful also in operations on the trunk, neck, and head by shutting up the blood in all or several of the extremities, and thus forming reserve depôts