to the lower animals. The heart of the amphibious frog has but one ventricle, and the reptiles afford numerous instances of incomplete division, the complete septum being constantly found not till we reach the bird level. Again, patent foramen ovale is constant in the human fetus, and not rare throughout life, while minute defects, such as to permit the passage of a bristle, are common. Such conditions as these may well have lent a semblance of likelihood to a false anatomical preconception.

As against this capital anatomical error we must set to the credit of Galen his reiterated assertion of the existence of anastomoses between the terminal ramifications of arteries and veins, both systemic and pulmonary. The bridging of these gaps, speculatively at least, was a condition precedent to the discovery of the circulation. Erasistratus had stood sponsor for potential anastomoses, those of Galen are actual, and he claimed to have proved their existence experimentally, by showing that it was possible to drain all the blood out of the body by a wound in a single artery. He explains exactly how the interchange of arterial and venous blood takes place, diastole of the artery drawing blood out of the vein and systole letting it back.

As in the systemic system, so in the pulmonary, Galen asserts the existence of anastomoses, by which some small amount of the blood brought by the pulmonary artery to the lung finds its way directly into the pulmonary veins and so into the left ventricle. He was confirmed in his belief by the consideration that the pulmonary artery is far larger than would be necessary if its purpose were merely to give nourishment to the lung. The mechanism of transference he explains thus:

When the thorax contracts the pulmonary veins within the lung are driven in and compressed on every side, and force out very speedily the inspired air that is in them, and at the same time take up a certain amount of blood by these tiny communications. Now this could never happen, were the blood able to flow back into the heart through the orifice of the pulmonary artery. But its return through this great opening being prevented, a certain portion of it distils into the pulmonary veins by the minute orifices mentioned.

Thus Galen, building on anatomical foundations laid by Aristotle, made one step onward towards the discovery of the pulmonary circulation, though he shows no sign whatever of understanding its fundamental importance. In effecting this pulmonary transit of a small quantity of blood, Galen makes it clear that the motive power is derived from thoracic compression of the pulmonary vessels, and not from the muscle of the right ventricle; indeed, he decides definitely that the heart wall is not muscular.

Galen is well-nigh as vague as Aristotle as to the source from which the blood derives its motion; sometimes he asserts the movement and seems to regard explanation as superfluous or impossible; at another time he seems to regard alternating diastole and systole as the efficient cause of flux and reflux, not only locally, but throughout the vascular system. Inconsistencies are frequent in Galen's physiology, because he does not hesitate to manipulate it so as to establish a thesis; but we shall not condemn him overmuch if we bear in mind how few years separated him from the time when the whole of physiology was armchair speculation.

If Galen had not decided that the heart was not muscular he might well be acclaimed the first exponent of the myogenic theory of its activity, for he locates the stimulus to activity in the heart itself; he attributes to it an inherent tendency to pulsate (*δύναμις σφύγγικη*), which is equivalent to saying that the heart pulsates because it pulsates. It was impossible for him to refer the cause of the heart beat to the blood, as Aristotle had done, for he knew that rhythmic activity may persist for a while in the excised mammalian heart; he was driven, therefore, to make it inherent in the heart. It cannot be said that even now we are provided with a much more satisfying answer, though splendid additions have been made in recent years to our knowledge of the site of origin and the route of propagation of the impulse through the heart, mainly by the work of Gaskell, Kent, Keith, and Flack, who have worthily maintained the pre-eminence won by Harvey for this country in the domain of the physiology of the vascular system. In recognizing the primacy of the right auricle, as the first part to live and the last part to die, they were following in the footsteps of Galen, though for

the auricles generally Galen had scant respect, regarding them as introduced into the vascular system as a provision against the too violent strain of ventricular diastole on the veins that open into them. Galen also knew that contact with cold water tended to arrest pulsation.

Galen performed just the same experiment as Harvey in opening the pericardium and observing the movements of the heart, but failed entirely to draw the same conclusions as to the orderly sequence of movements in the various chambers of the heart; he did not even perceive that auricles, like ventricles, have both a systole and a diastole.

Galen proved by a vivisection experiment that Aristotle was right in saying that the arteries contained blood and not air. He placed two ligatures upon an artery and divided the vessel between them, when it was found to contain only blood; corroboration was afforded by plunging a cannula into the left ventricle, when blood flowed out instantaneously without any escape of air.

Galen tells a delightful story of such a demonstration of the presence of blood in the aorta, which shows incidentally that the medical student has remained true to type for some 1,800 years. Some ignorant anatomist repeatedly promised to demonstrate that the aorta contained no blood, but never got beyond promises, though Galen's students brought him animals and begged him to show them; the man, however, took refuge in demanding payment for the task. Thereupon the young men put down between them some 1,000 denarii, for him to pocket if he was successful, but this only produced a further crop of excuses. At last, however, their persistence prevailed, and he summoned up courage to take a scalpel and open the left side of the chest, where he fancied he would get the best view of the aorta, but he exposed his ignorance of anatomy by cutting down upon a bone. Then the young men, who had tabled the stakes, jeered at him, and undertook to carry out his demonstration for him. Opening the mediastinum, as they had seen Galen do, without wounding any of the vessels, they quickly passed two ligatures round the aorta, one near its origin from the heart and the other close to where it meets the spine; then they confidently promised that when the animal was dead, they would show that the part between the two ligatures contained no blood. But, lo and behold! when it was opened, there was blood in the vessel!

THE ADVANTAGES AND DISADVANTAGES OF GAUZE PACKING IN ABDOMINAL OPERATIONS.

BY

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In attempting to arrive at a conclusion regarding the conflicting opinions and practices of surgeons on any particular method of operative treatment no more satisfactory deciding factor can be found than that derived from prolonged practical experience coupled with careful observation. It is on such a basis that I venture to offer a few remarks upon a subject with regard to which we are as yet far from any unanimity of opinion or of practice.

The present attitude with regard to the use or non-use of gauze packing in abdominal operations may be briefly expressed by saying that there are surgeons who believe in the good effects of this agent in ensuring a more satisfactory result; and there are surgeons who equally hold that its use is fraught with ill effects. My effort will be to bring forward reliable statements of facts bearing on both sides of the subject, so that it may be possible for an impartial opinion to be formed. If the facts adduced sufficiently prove that the use of gauze packing is or can be harmful then its employment should unquestionably be abandoned. But we have ever to remember, in mitigation of such a statement, that surgical resources are not bound by rigid limitations; that where in one case a certain practice may be beneficial, in another the adoption of the same measure may be harmful. Careful and reasonable discrimination is needed to decide when a particular method of treatment should be employed, and when it should be avoided. If the element of risk can be shown

constantly to be present, then, even in the face of possible good, it becomes a question whether any particular line of treatment should be persisted in. In considering the facts connected with the two sides of the subject, it may, in the first place, be stated, probably without contradiction, that the question of the use or non-use of gauze packing only arises in operations upon the abdomen where sepsis in some form is found to be present. In by far the larger number of cases these operations are concerned with inflammatory affections of the vermiform appendix and the female pelvic organs. The frequency with which pus or necrotic tissue is present in inflammatory diseases of these viscera naturally leads to the desire to combat effectually the possible extension of one or other of these pathogenic processes.

THE ADVANTAGES OF GAUZE PACKING.

We may fairly assume that the effects we see which result from the use of antiseptic gauze packs in external wounds of the body similarly result when these same agents are used for intra-abdominal lesions. The gauze pack becomes freely saturated with the exudates poured out from the lining walls of the space which has lodged necrotic tissue or been the cavity from which pus has been evacuated; and the assumption is probably correct that the antiseptic agent within the gauze has a sufficiently sterilizing effect upon these exudates to prevent any further septic advance. Again, it is also probably correct to assume that this absorption, by admitting of direct contact of the gauze with the lining walls of the septic area, excites a normal reaction and reparative influence upon the surrounding parts; in other words, it induces the formation of healthy, healing granulation tissue. It would appear therefore that, so far as serving to check the advance of sepsis and to stimulate the formation of a healthy granulating wound, packing with antiseptic gauze is distinctly advantageous. Thus, one may not unreasonably infer that the beneficial effects obtained in the use of gauze packing for external wounds would accrue equally in the case of similar lesions occurring within the abdomen. And if there were no other considerations which entered into the subject, it might justly be concluded that packing with antiseptic gauze a septic intra-abdominal wound was at least a reasonable, if not a generally advisable, line of treatment.

But whatever the analogy between septic processes taking place within and without the abdomen, there is absolutely none between the parts involved. The peritoneal cavity with its viscera introduces an entirely new aspect. There is nothing comparable between these parts and the external soft tissues of the trunk and extremities. Inflammation of these latter may have some impairing results, but they will be nothing to compare with what may accrue should the bowel or the peritoneum be involved in a septic process. It is the introduction of these important factors into the discussion that raises the question of the possible disadvantages connected with the use of gauze packing in the treatment of intra-abdominal septic wounds.

DISADVANTAGES OF GAUZE PACKING.

It has already been indicated that the contact of gauze packing with the walls lining any septic space has a stimulating, if not an irritating, effect upon the granulations of these walls; this, in so far as it affects certain soft tissues of the body, may be a perfectly beneficial influence. But what is the effect upon such a sensitive structure as the peritoneum?

Let me describe a rather instructive experiment which was unintentionally made when operating upon a case of pyosalpinx. Before attempting to deal with the pelvic matted mass, some dry, simply sterilized gauze packing was introduced into the upper part of the wound or peritoneal cavity to protect the intestines, as well as to prevent their descent upon the septic pelvic area when this latter was freely exposed. It took about half an hour to complete the pelvic part of the operation. The gauze packing was then withdrawn, and in doing so it was found that it had already become intimately adherent to the visceral peritoneum covering a loop of small intestine. On peeling off the gauze an acutely injected surface was exposed, its rose colour and slightly roughened surface forming a very striking contrast to the smooth, glistening, grey serous tunic of the healthy neighbouring coils of bowel. The

difference was sufficiently marked to be noticed by my assistants and others whose attention I drew to a fact that seemed to me, when rightly judged, to possess no little clinical significance.

Let me instance another very instructive case:

Mrs. M., aged 33 years, was admitted to the Victoria Infirmary in May, 1906, suffering from gall stones. Operation was performed, and stones were removed from the gall bladder and one from the common bile duct.

She remained well for some years, but was again admitted to hospital in 1912—that is, six years after the first operation, for a recurrence of biliary colic. Operation at this time revealed the presence of a stone impacted in the ampulla of Vater. The stone was removed by first opening the second part of the duodenum, and then incising over the stone. The incision was stitched up; and, to secure against leakage from the bowel, a piece of iodoform gauze packing was placed upon the incision and led out of the parietal wound. By some unfortunate oversight in the subsequent dressing of the case, the gauze plug was allowed to slip unnoticed into the wound. The parietal wound healed well, and the patient made an uninterrupted recovery. About six weeks later the patient returned to the infirmary complaining of gastric symptoms which very evidently indicated obstruction. The abdomen was opened, and a mass of adhesions so dense and firm existed in the region of the pylorus—evidently the result of the two prior operations—that it was thought better not to attempt to separate them. Believing them also to be the possible cause of the obstruction, the operation of posterior gastro-jejunostomy was proceeded with. However, when the stomach was opened prior to the fixation of the jejunum, and the pyloric aperture examined, both it and the first part of the duodenum, instead of being narrowed, as was anticipated, by external adhesions, were markedly dilated, proving that the cause of the obstruction must be lower down. On pulling up the first part of the jejunum, preparatory to completing the anastomosis, it was found to be filled with some semi-solid material, somewhat sausage-like in shape and consistency. On opening the bowel, a piece of gauze presented. On withdrawing it, it was found that the upper end was matted together in the form of a knob, quite scentless, but the other end tapered off, and extended some distance down the bowel. It had a distinct faecal odour. The operation of posterior gastro-jejunostomy was proceeded with, and the patient made an uninterrupted recovery.

There is but one explanation, I think, of the condition found—namely, that the gauze plug used at the second operation had ulcerated its way through the parietes of the second part of the duodenum, and been carried down by normal peristaltic action to the upper part of the jejunum, where, for some unaccountable reason, it had stuck, and proved the source of the obstruction. Another somewhat similar case is worthy of narration.

It was in 1910 that I operated in the Victoria Infirmary upon Mrs. T., aged 49 years, for well-marked pyloric obstruction. Gastro-jejunostomy was performed. As a protective measure, prior to making the anastomosis a plug of gauze with tape attached to one end was inserted into the abdominal cavity—a practice constantly carried out. A pair of pressure forceps is attached to the end of the tape to prevent the possibility of the plug slipping into the abdomen and being forgotten to be withdrawn. In this particular instance the forceps cannot have been attached, and the tape must have got pushed into the peritoneal cavity and been overlooked. She made a good recovery, and left the infirmary about a month after the operation, taking her food well and suffering from no discomforts.

I was asked by her doctor to see her about two years later for acute intestinal obstruction. He then told me that about three months after she left the infirmary she noticed a string, as she called it, protruding from the anus, which upon being pulled withdrew a long strip of gauze. For the acute obstruction she was at once removed to the infirmary and operated upon. Some adhesions were encountered, and one band which passed across a loop of bowel, considerably constricting it, was obviously the cause of the obstruction. A linear scar was noticed on the anterior surface of the sigmoid flexure, and this, as far as it was possible to discover, was the only evidence to suggest that the gauze may have made its entrance into the bowel at this spot.

It is not unreasonable to assume that the adhesions which were found, together with the constricting band, were the result of a chronic adhesive peritonitis set up by the presence of the gauze for some time free within the peritoneal cavity. Inasmuch as it was only three months after the operation upon the stomach that the patient withdrew the plug from the rectum, it was at least within this period that the gauze had ulcerated its way into the intestinal canal.

My object in introducing these two cases is not to illustrate the risks attendant upon the use of gauze for strictly operative purposes—risks which may be avoided, and which when followed by untoward results might justly be attributable to a certain amount of culpable

neglect—but to support the deduction which I intend to draw that the presence of gauze packing in contact with healthy bowel for any length of time may result in the visceral walls being perforated. I have, on not a few occasions, noticed that, on withdrawal of a gauze pack which had been left in the wound for a few days after the operation, a faecal discharge has, if not immediately, in a day or two, ensued. One could not be certain that the gauze was the cause; but the sequel has been too frequent not to make one somewhat suspicious of its being so. It was only after noticing the very striking and comparatively rapid effect of a piece of dry gauze in contact with the bowel for so short a time as half an hour—as illustrated in the first case narrated—that my suspicions seemed confirmed. It is quite possible that, had the gauze been previously wrung out of a warm saline or sodium citrate solution, this rapid adhesive effect would not have been produced. But with such results as those which accrued in the latter two cases it is hardly possible to conceive that any different course would have been pursued by the gauze had it been dry or moist. For, if used dry, it must soon have become soaked with the exudates, and so acquired much the same condition as that originally inserted moist. It is reasonable, however, to infer that a solution such as that made with sodium citrate, when saturating gauze tissue, will render it less irritating to the peritoneum—for the comparatively short period of an operation—than if the material had not been so treated and had been employed dry.

There may be said to be four other disadvantages arising out of the use of gauze packing, and these are in more or less direct proportion to the length of time the packing is retained. One is that if the packing be employed in septic cases without the adjunct of a drainage tube, it may act as a dam to the escape of any discharge. As soon as the gauze has taken up the exudates to the limit of its absorptive power, the overplus must either make its exit through the meshes of that part of the pack which is led out of the parietal wound, or it must accumulate in the infected region or be diffused further afield.

A second disadvantage is the possible, and, indeed, probable irritative effect of the packing upon neighbouring coils of healthy bowel, leading to a low form of adhesive peritonitis. Coils of intestine may thus become matted together or become adherent to the parietal peritoneum, and the adhesion so resulting may in some way lead to obstruction.

A third disadvantage is that whenever an opening is maintained through the parietal wound for any time—and the longer the time the more likely is the accident to happen—a weakened cicatrix is almost the inevitable precursor of a ventral hernia.

And, lastly, the withdrawal of a gauze pack is a very painful process. The degree of painfulness is possibly dependent upon the amount of gauze in contact with, and probably to some extent adherent to, the peritoneum lining the abdominal parietes. It is a known fact that while the visceral peritoneum possesses little or no sensitiveness to mechanical irritation, any friction or undue pressure upon the parietal peritoneum causes pain. So great is the pain in some cases when a "pack" or "plug" is being withdrawn that the administration of an anaesthetic becomes necessary.

In thus indicating the advantages and disadvantages of the use of gauze packing in intraperitoneal work, I have sought to do so by simply stating facts, the result of my own personal experience in abdominal surgery; the disadvantages would seem to so greatly outweigh the advantages that but one conclusion appears warranted—that gauze packing should be avoided except under definite and clear limitations. These limitations may be thus expressed: the use of as small a piece of gauze as possible and for as short a time as possible, which equally connotes the avoidance of large packs retained for several days.

A RECENT enactment of the Government of the Argentine Republic forbids pregnant women to work for a month before the expected date of delivery, and requires mothers to rest for forty days after confinement. They are to receive their full wages during both periods. Every factory and workshop where they are employed must be provided with rooms furnished with cradles, and mothers must go there for fifteen minutes every two hours to nurse their babes.

REMOVAL OF TONSILS AND ADENOIDS.

BY
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THE admirable paper by my friend and former house-surgeon, Mr. W. H. Bowen, in your issue of October 4th, on the whole question of operation for removal of tonsils and adenoids deserves to be carefully read. It seems to me the soundest presentation of the subject we have had for a long time. I ask permission to emphasize one point, and to differ on another.

I.

That complete removal of the tonsil can be effected by the ordinary Mackenzie guillotine I have demonstrated for many years. That I have not succeeded as often as I wished is probably, and I hope is, due to my ignorance of the method described by Mr. Bowen. The ring, as he points out, needs to be placed behind and below the tonsil. Standing on the right side with the head very slightly inclined back, the left tonsil is first removed. The handle of the guillotine is brought across to the right, the fingers of the left hand press the tonsil inwards, while the thumb presses the blade outwards. Thus a firm grasp is secured. The head is immediately turned to the right and the blood swabbed away. Then the process is repeated on the other tonsil, the operator remaining on the patient's right. The fingers of the left hand control the blade while the thumb presses the tonsil inwards from behind the angle of the jaw. Mr. Bowen uses the guillotine with blade reversed, as have others, but the special feature to my mind is the manner in which he manipulates the inter-palatal portion of the tonsil into the ring of the instrument. If it falls to my lot to remove any more tonsils this method must be tried, though a few days ago both tonsils on removal by the method described showed rounded capsulated deep surfaces.

II.

Is complete extirpation necessary? What amount of relief has followed partial removal? and in what proportion has recurrent tonsillitis occurred? These are important questions, especially in view of the large number of children now submitted to operation under the education scheme.

Some years ago I collected the after-history from private cases over a period of ten years and found the results had been almost uniformly good. Recurrence was very exceptional, and I can recall only one case requiring a repetition of tonsillectomy. I doubt if there be 1 per cent. of recurrence in children. If so, the modern operation of complete removal by dissection, involving as it has done serious bleeding, followed at times by anaemia, and sometimes by death, requires much to justify its general adoption.

My long experience and my notes of cases convince me that the guillotine is the best instrument. Those who operate frequently will develop modifications of their own, which they may think suitable for general adoption. It must be remembered that safety is a matter of the first importance, that the operation is widely practised, and by many with limited opportunity of acquiring dexterity.

No doubt in most operations the deep portion of the tonsil remains. Though the amount of harm that results is very small indeed, I have for some years removed this remnant by a curette, and think with benefit. Hartmann's right-angled adenoid curette is the most convenient, but any sharp spoon will answer.

III.

The point on which I would differ from Mr. Bowen is the anaesthetic employed. In a well organized unit of experts, constantly doing team work, risks are reduced to a minimum, and the anaesthetic securing the most rapid effect and quickest recovery will be employed. But again, for wide employment and by persons of varying experience I cannot think that ethyl chloride is safe, nor does it give sufficient time for any but the dexterous operator who can complete removal of tonsils and adenoids in two minutes. Even then I much doubt if there be sufficient time to clear Rosenmüller's fossa when filled with soft adenoid tissue. For these reasons I have never