

THE TREATMENT OF APPENDICEAL PERITONITIS

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To the average layman, appendicitis today is being considered as a disease entity which is not to be taken in a serious vein. Due to this erroneous conception, there has been an ever increasing number of deaths dependent upon appendicitis in the United States, until today they have reached the astounding number of approximately 20,000 yearly. Simple, uncomplicated appendicitis, it is true, has a very low mortality rate, this rate being below 1% and falling well within the sphere of deaths which will occur following any major surgical intervention. However, it is when the pathology spreads beyond the appendix that the tragic note is struck, for here the clinician is dealing with a condition that tests the best that his judgement can offer, and the treatment for which has been, and according to all indications, will continue to be, a matter of great controversy. It is within this latter group that over 95% of deaths due to appendicitis have occurred and until earlier diagnosis and early treatment will begin to play their necessary roles, that these deaths will continue to ensue.

The responsibility for this condition lies partially in the hands of the patient and partially in the hands of the physician, both having their jobs to perform, and upon whose shoulders equally rests the guarantee of early and proper therapy. The acute abdomen offers



the greatest challenge for diagnosis of any of the conditions presented to the general practitioner. So numerous are the possibilities that have to be considered that seldom can any go unconsidered. Most important are the ruling out of those conditions where surgical intervention might prove fatal, these in brief being lobar pneumonia (especially in children, in which the diaphragmatic pleura is involved), acute nephritis, idiopathic peritonitis, coronary occlusion or thrombosis and amebic dysentery. The type of onset and chain of circumstances which take place in acute appendicitis are pathognomonic and therefore should be kept well in mind:

1. Pain-- most common in the epigastrium.
2. Nausea and vomiting following (1.).
3. Pain localized in right lower quadrant.
4. On questioning, the patient will usually reveal a previous constipation.

Physical examination reveals:

1. Right lower quadrant tenderness with more marked tenderness and hyperesthesia over McBurney's point.
2. Rectal tenderness.
3. Patient lies on right side with thighs and knees flexed.
4. Leucocytosis.



It must be remembered that while the above are the important points, many variations are possible, and that simply because a patient does not have all of the above listed points, it is entirely possible that he may still have an acute appendicitis.

It is generally conceded that classifications of disease entities, or groups of entities having a common background are too often misleading and falsifying. The old axiom that "nature doesn't classify" is entirely true, and yet some definite categorization seems necessary for a full understanding of the various paths that a simple acute appendicitis may take in order to comprehend fully the pathology, physiology, treatment and prognosis of complications attendant on acute appendicitis. These schema are merely designed for such purposes, for it is often hard to tell where one stage stops and the next starts. In reviewing the various classifications presented, one is impressed by the marked similarity in the schema set up; the most striking of these being the almost immediate separation into two types-- those with the pathology confined entirely within the appendix and those with pathology extending without the appendix. Sub-classification from this point on is merely a matter of personal difference and may or may not be accepted in toto as the individual desires. One important point mentioned is the separation of acute ap-

pendicitis from acute appendicular obstruction. In the latter, the course is much more rapid, and as a result, perforation occurs much sooner after onset of symptoms. With perforation, three rather definite types are considered: *used correctly, which may develop into an abscess.*

1. Those which have just perforated. *palpable firm*
2. Those with abscess formation. *fairly well*
3. Spreading or diffuse peritonitis. *ade fever.*

These three types should be kept definitely in mind as much of that which is to follow will be based on this so-called classification. *little as previously given.*

Granted that a case of acute appendicitis is diagnosed correctly, but is seen at a late date, what then are the symptoms and signs of perforation? This unfortunately is often a matter of conjecture. One is not in a position to determine internal pathology and unless a late case of peritonitis is seen, what is to be the diagnosis? A question vital to the course of future treatment (depending, of course, upon which school of thought you subscribe to) is the latter. Relief of pain usually temporarily follows rupture, but the point is raised as to why it should occur here and in no other place in the body. The explanation may lie in the fact that just previous to perforation, gangrene or interference with circulation may lead to anesthesia of nerve endings. Other symptoms and signs which occur later

are vomiting, rapid pulse and respiration, more diffuse rigidity and tenderness, increased temperature, often going to 104° F., and high leucocytosis. One should also always bear in mind that a local peritonitis can be diagnosed correctly, which may develop into an abscess. Symptoms and signs of the latter include a palpable firm mass, rigidity and tenderness which is fairly well localized, moderate leucocytosis and low grade fever. It is still further possible that this abscess may again rupture, in which case one finds all the symptoms and signs of spreading peritonitis as previously given.

For further understanding of the principles of correct treatment, a knowledge of the bacteria presents is essential. Not only do the varieties of organisms vary greatly, but the number of types present in the same infection is also a very indefinite thing. In reviewing the literature, one is impressed with the persistence of certain of the organisms. *B. coli* is almost always present, and of the anaerobes, *Cl. welchii* is the most often seen and is present in the greatest number of gangrenous appendices. Of the aerobes, *B. coli*, a non-hemolytic streptococcus, diphtheroids and *B. lactis aerogenes* were most often seen. Anaerobes varied more widely than the aerobes, but combining the two, it is seen that in over 50% of cases, four or five organisms are seen. Thus the bacterial flora are complex



and bizarre. With increasing number of strains, the proportion of anaerobes is increased until they become rather preponderant. Experimentally, the organisms obtained from the lumina of normal appendices and from peritonitis were almost identical. It was further seen that there is a definite synergistic action between the organisms, which definitely leads to lethality. However, in considering the whole of the situation, the universal concepts of dosage, virulence and resistance still must be considered as basic and one must not allow himself to be led astray by any one preconceived idea, but to consider all aspects and with these in mind, then and only then try to help nature.

In attempting to review some of the massive bulk of literature written on the treatment of appendicial peritonitis, one is immediately impressed by the continuous battle that has raged since the turn of the century over the relative merits of the so-called conservative treatment vs. the so-called surgical treatment. A thorough job of truly evaluating all that has been presented would be a herculean task and it is merely the purpose of this paper to present as unbiasedly as possible some of the types of treatment used, physiological basis for each, and results obtained. The

reader is to be left to his own judgement to choose the advantages and rationale for the various methods and to reject that which he considers faulty and/or unnecessary.

Basically both broad groups of surgeons (i.e. whether they believe in operative or non-operative treatment) are attempting to accomplish the same thing, namely to localize an infectious process and by doing so to bring the weight of advantage into the host's favor. The one believes in part in mechanical intervention for the establishment of resistance; the other favors physiological principles entirely for his method of arousing immunity. The two sides of the picture will be presented, not necessarily in order of preference, but merely in the way that my material has been compiled.

The first one to highly publicize and bring out the advantages of the non-operative treatment was A. J. Ochsner who wrote his article in 1900. His reasons were based on pure hypothesis and clinical observation. He never meant his treatment to be a substitute for surgery, but merely a preparation for it. As the basis of his methods, he advocated both physiological and mechanical rest, claiming that the blood supply of the omentum was great enough to wall off the infectious area, if it was permitted to concentrate on this one function.

However, with administration of food, etc., peristalsis is stimulated, not allowing the immune processes to exert their proper influences. Moreover, peristalsis by the waves set up, allowed for mechanical spread of the infection.

The peritoneum displays, as would be expected, all the inflammatory phenomena which are characteristic at any point in the body. It is thus capable of having fibrinous adhesions built around an injected area. This portion, if left alone, will be walled off and soon be replaced by fibrin. Moreover, the surrounding tissues and organs will contribute toward this barrier and if they are disturbed, an area of resistance is also broken down. Thus surgical intervention will do two things:

1. Break down the area of immunity, and
2. Cause mechanical spread by handling of infected parts and then touching other areas.

Perhaps one of the strongest points of difference in method of treatment is the use of drainage by those favoring surgery and the non-usage by those advocating conservatism. Since at this point we are considering reasons for non-intervention, it is in order to point out what the experimental and clinical observations have been on the use of drainage therapy.



Drainage of the peritoneal cavity was universally accepted as a worthy and proper procedure until the momentous paper of Yates in 1905 showed its futility. He pointed out that every foreign body is an irritant and may give rise to adhesions; this of course would include drains, no matter what their type. Thus there is close application of the serous surfaces to the drain and its subsequent encapsulation in adhesions. Furthermore, if drainage of the peritoneal cavity is possible, it is further restricted by the limited capillary action of the gauze. The drains in common usage excite irritation which in turn leads to an extra amount of fluid and therefore the fluid drained is not of the type desired, but is merely serous exudate. There is further danger of infection around the drainage tube, which may or may not incite further complications, such as

1. Hernia,
2. Fecal fistula,
3. Internal obstruction, and
4. Ileus.

Experimentally, Yates went on to prove the ineffectiveness of drainage and found

1. Adhesions usually surrounding the greater part of the tube by the end of the first day,

2. Serous discharge for the most part comes from the tract about the drain,
3. Using gauze, it was found that transudate was taken up rapidly, exudate slowly, and pus not at all.

From these observations, he came to the following conclusions:

1. That drainage of the peritoneal cavity is physically and physiologically impossible.
2. Serous exudate is immediate and is followed by fibrinous adhesions which completely encapsulate the drain. The encapsulation is often done by omentum and parietal peritoneum and is preventing these parts from functioning toward some other end.
3. Postural methods are futile.
4. Peritoneal drainage should be local.

In spite of the above proof of ineffectiveness, the rationale of drainage as used today is based on the erroneous belief that the absorption power of the peritoneum is not sufficient and therefore drains are needed to facilitate healing. It is true that the absorption power of the peritoneum is no greater than that of any other serous membrane, and occurs chiefly in the region of the pelvis, but as has been pointed out, is still impossible to drain. The character of the peritoneal exudate has no bearing on the effectiveness of the drain or its freedom from interference by encapsulation.

It is generally agreed, however, that total disregard for drainage is as dangerous as the indiscriminate use

of it. Where then should drains be used, according to advice given by advocates of this method. (It must be first understood that almost all of the below listed places necessitate previous inspection of the peritoneal cavity.) Firstly, where there is necrotic tissue present, as the latter serves as culture medium for pathogens. However, in answering this question, proponents of non-drainage say that there is bound to be necrosis with any infectious process. Secondly, where there is a walled-off pocket. This point is almost universally accepted today, the one line of difference being as to when to insert the drain into this area. This will be discussed later in the paper. A highly controversial point which as yet has not been definitely settled is whether to insert a drain just beneath the point of leakage, i.e. at the place of perforation. This is far from settled.

In summary of drainage therapy, we find that according to recent reports, there is a definite trend away from the old adage, "When in doubt, drain". The surgeon today is confining its use to definitely selected cases and in those clinics where it is fairly routine, drains are used in two places for the most part

1. along the anterior abdominal wall
2. into the pelvis.

When used, they are carefully placed as to avoid encap-



sulation in bowel, as it is well recognized that they are stimulators of adhesions and secondarily as causative factors of intestinal obstruction and ileus. Clinical statistics have moreover shown that mortality is as high or higher when drains are used as when they are not. Experimentally on dogs, it has further been shown that mortality rates have decidedly increased when drains are used and in one series, this figure went up to 100%. Thus one sees that today there is more realization of the limitations of the use of drains and that only certain advantages and uses can be expected and that with indiscriminate use, complications and prolongation of hospitalization are markedly increased.

The use of operative therapy after the diagnosis of peritonitis has been made may take one or more of several forms depending upon the surgeon. Each has his method and each his ideas as to what or what not should be done, according to how conservative or radical he may be. All proponents of surgical intervention say that the best time for operation is immediately after perforation. This is readily understandable. In addition, there are many of the conservative school who make this time the one outstanding exception to an otherwise wholly conservative program.

At present, the incision of choice is the McBurney's incision. Among the many reasons and advantages described are:

1. It allows for easy accessibility to the appendix and by doing such prevents excessive handling of tissues.
2. Very little packing is required, thereby preventing mechanical spread of infection. This also prevents excessive irritation which may lead to adhesions.
3. Less post-operative herniae occur, since the anterior abdominal wall can be closed in layers, thereby preventing weakness.

The surgery, as has been stated, varies. That the appendix should be removed, if once exposed, is generally accepted. Here too there is one exception made, that being that if the appendix forms a part of an abscess wall, leave it alone. As to the procedure of removing the appendix, we again find variation. Certain surgeons advocate ligation at the base to be followed by inversion of the stump, while others merely allow for ligation. The reason for eliminating any extra steps in the case of the latter is to prevent any excessive manipulation of tissues. As far as possible, manipulation and spread is also eliminated by the use of suction to withdraw any fluid or any other material present. In this way, sponging and its resulting contamination of surrounding tissues is prevented. Once the above procedures have been carried out, a quick exit should be made. The old time practice of perfusing the

peritoneal cavity with various types of solutions has long since been abandoned. Not only has this procedure been proven to be without value, but it is actually dangerous. It is physically impossible to get rid of the infective agents by perfusion and perfusion merely acts as a means of dissemination of these organisms already present. If drains are to be placed, they are inserted just before closure of the peritoneum. The placing of drains and the relative merits and disadvantages of such a procedure has already been discussed.

The closure of the wound presents a further problem. One author goes so far as to state that infection of the anterior abdominal wall plays a more important role in the causation of fatal sequelae than any other factor. Of course, this seems exaggerated, but it does emphasize the importance of proper closure for best results when using surgical means. Closure layer by layer of the anterior abdominal wall provides both a culture medium and an incubator for growth of anaerobes. Air therefore would seem to be a natural prophylactic measure for this newly prepared field. The necessity of allowing air to enter the wound is now well recognized. Means of accomplishing this vary. Among the methods listed are



1. Leave the wound open down to the peritoneum without dressings with a heat incubator surrounding the area.
2. A pack is inserted into the wound for the first twenty four hours-- this pack usually being soaked with some bacteriostatic agent.
3. Close the wound loosely.

The most common, but fortunately not a very lethal, complication is abscess formation. As far as can be determined, the method of treatment is not a very important factor as regards the incidence of abscess formation, as it seems to occur as often with non-operative as with operative treatment. Due to the widespread pathology, it is easily conceivable that they may occur in many and varied regions, but by far the most common site is in the region of the original infection for those who are treated conservatively, and in the pelvis when both groups are considered collectively. The symptoms and signs of an abscess usually begin to manifest themselves from the fourth to the seventh day, although these may occur at any time in the course of treatment. It must be understood that many of these listed can readily overlap with those due to the peritonitis itself and that a diagnosis of abscess formation therefore is often based on what the surgeon has seen previously. A persistent fever, the presence of a palpable mass (which may be observed to be growing larger), pain

over a localized area, diarrhea and swelling of the external genitalia in the case of a pelvic abscess, and above all-- persistence of toxic symptoms-- should all point to a diagnosis of an abscess. Once the diagnosis has been established, the plan of treatment again presents a subject for debate. Most believe that conservatism should be practiced unless the mass is near the anterior abdominal wall, in which case it can be drained extraperitoneally. Attempts at drainage of abdominal or pelvic abscesses are very dangerous and over-spilling will often lead to extension of infection. If an abscess should rupture spontaneously into the peritoneal cavity, ultraconservatism is the rule.-- Drainage in this case will be very futile and dangerous. The importance of recognition of abscesses cannot be overemphasized, for while they are not great sources of trouble if handled properly, they are potentially dangerous, and as such, must be treated correctly; conservatism here, as with abscesses any other place in the body (unless they are superficial) is the generally accepted means of therapy.

Once surgery has been done, treatment thereafter conforms very closely to that which is done in the so-called conservative method. Many variations exist, depending upon the number and choice of procedures used.

The various procedures are great in number and only a percentage of them is used by any one man, but it would be best if only those were used that have been proved to be most efficacious. The proof, however, is often difficult and as a result, we find men conforming only to those with which they are most familiar and in whose hands these are seemingly the most valuable. I shall attempt to bring to the reader's attention some of the methods more commonly used and accepted, with the understanding that the procedures are employed by men of both schools. In reality, both schools are using the same methods, the one merely adding surgery to all other devices.

Perhaps the most widely accepted rule is the discontinuation of all food-- both liquid and solid-- by mouth. Absolute rest of the gastro-intestinal tract is essential-- peristalsis must be stopped to allow for localization of the infectious process. Of course, this is of great discomfort to the patient who desires fluid for his dried mouth and lips. This can be accomplished, using ice chips and small sips of water-- with the use of the Wangenstein apparatus which will be discussed in more detail later. It is true that intestinal tone must be maintained to prevent ileus, but peristalsis at the same time must be inhibited to allow for full



localization. The other measures employed to insure rest and to stimulate healing are:

- (1) Heat to abdomen-- this stimulates an inflammatory reaction and as a result brings a greater blood supply to the part thus helping in healing. It also is very comforting to the patient and as a result insures ease and quiet.
- (2) Fowler's position-- the actual value of this procedure is not entirely certain . It was originally thought that the pelvis had greater absorptive powers than the upper portion of the peritoneum. Recently this idea has been questioned, but nevertheless it remains as one of the standard procedures.
- (3) Morphine given p.r.n.-- to insure lack of apprehension and to keep up intestinal tone.
- (4) Siphonage drainage through a nasal catheter. The purpose of this apparatus is to withdraw from the stomach secretions and any other fluids and gasses present which ordinarily would pass through the gastro-intestinal tract. They in turn stimulate peristalsis, whose dangers have already been shown. It also serves as a decompression mechanism to prevent distension, which may be the cause or result (or both) of paralytic ileus, the usual cause of death in peritonitis. Thus it should be used as a prophylactic measure against paralytic ileus and not as a therapeutic measure, once it has become established. The importance of this device cannot be over-

emphasized, for it is one of the truly few advances made in the last twenty years in the treatment of peritonitis.

In addition it adds to the patient's comfort by allowing him to take occasional small sips of water--as this will be returned immediately through the siphonage and thus does not act as a stimulant for intestinal activity.

It can be used still further as a test to see if intestinal function has been restored if the patient has apparently recovered from paralytic ileus. A known quantity of water can be given the patient with the suction turned off. At the end of two or three hours, withdrawal of fluid can be done and thus one is readily able to see if any absorption or movement has taken place.

(5) Use of parenteral fluids. Long recognized is the necessity of maintaining the water and salt balance of the body; this to be done however possible and with the greatest possible care. Relatively recent however is the use of parenteral fluids as administered by hypodermoclysis and venoclysis-- and the careful studies involved concerning their use. At the turn of the last century, feeding was done almost entirely per rectum, but due to the distension and discomfort caused by this method, it has been almost entirely abandoned.

As a result of many studies, reckless use of indiscriminate amounts and kinds of fluid has been definitely on the wane. Firstly, it is necessary to know the amount of fluids needed daily for maintenance of body functions. Ordinarily, a bed-ridden patient loses 1000 to 1500 cc. of water daily by vaporization through the skin and lungs and added to this he needs 1500 cc. for urinary output if he wants to prevent the kidneys from working at a maximum and also to insure proper elimination of waste products. With a low intake, the kidneys compensate by low output of high specific gravity, but when output falls below 500 cc. of urine/day, one has to suspect an impaired kidney function and there is a resulting rise in blood N.P.N. Decreased fluids also upset the heat regulating mechanism and when decidedly reduced lead to a hot dry skin and marked increase in body temperature. Fluid loss in the surgical patient is by necessity much higher due to blood loss and continuous oozing from the tissues in the operated areas. Moreover on returning to bed, he is usually encased in many blankets, thereby increasing his skin vaporization-- these patients therefore need larger amounts of fluid for the immediate post-operative course.

Patients suffering from peritonitis are often first seen in a dehydrated state, presenting all the signs



and symptoms of dehydration and the associated septic processes which have led to the condition. These patients have lost at least 6% in fluids of their body weight in order to show the indicated manifestations. Thus in administering fluids to these patients, the added amount to be given can be readily determined.

Most commonly used are dextrose solutions either in saline or merely by themselves. Dextrose serves three main functions:

1. Provides a ready source of energy.
2. Prevents or relieves ketosis.
3. Serves as a protection to liver damage.

Because of the ease with which dextrose is utilized and of the overspilling of that which is excessive, it is not particularly dangerous. However, saline solutions have to be used very cautiously because of the readiness with which they may lead to edema of tissues and degenerative changes in the heart and kidney when given excessively. When edema is seen, discontinuation of saline usually allows for clearing up of this swelling. Edema is especially dangerous when occurring in the lungs, as here it may readily predispose to pneumonia in an already very toxic patient. Because of these dangers, it is a very good plan to determine both the blood chloride and CO<sub>2</sub> combining power every two days. Equally

as important is the determination of these values in a dehydrated patient-- so as to know just how much saline is needed. By changing to K Cl, the edema is readily reduced and diuresis follows. It is the retention of the sodium radical that causes edema of tissues.

It is thus seen that very accurate measurements of units of fluids to be given can be made and that this therapy is no longer a matter of guesswork. All possible sources of output must be measured, including vomitus and the fluid withdrawn by the use of siphonage drainage, and in addition careful charts of output and intake as well as blood chemistry values should be done constantly so as to give the patient the greatest benefit of this therapy. Transfusions when used act in exactly the same manner and therefore should be considered as such. Thus it is seen that guesswork in fluid therapy can and should be kept at a minimum.

(6) Transfusions-- the use of blood transfusions has a very obvious purpose. Firstly, it serves as a method of giving fluids, providing along this line something that cannot be supplied by any artificial preparation. It brings to the body all essential items in their correct proportions and in addition provides red and white cells, whose value need not be stressed. Some advocate repeated small transfusions while others think that larger transfusions given less often are more advantageous.

No conclusive evidence has been established one way or the other as to their relative merits and it seems that in the end this will not make much difference.

The above listed methods have become almost routine in the treatment of peritonitis, whether surgery has been done or not. They do not represent however all that can and all that is done by surgeons today. Each man has various supplemental devices at hand that he may use routinely or that he may resort to only in times of emergency. No one man uses them all. I shall attempt to merely mention some of these, along with their purpose and not in all cases try to evaluate them, as they all probably have some merit-- the exact amount of which is not always known.

The use of sulfanilamide is certainly an altogether unestablished means of therapy. When used clinically and experimentally, it certainly has seemed to be helpful. The predominating aerobic organisms, it has been pointed out, are *B. coli* and a streptococcus of varying species. The potency of this drug in infections caused by hemolytic streptococci is certainly well known. The drug has been proven to be most efficacious in infections of the genito-urinary tract when the offending organism has been *B. coli*. This has served in part as the basis for its use in appendicial peritonitis



and according to recent reports, it has proved its value in this condition also. The administration of the drug must be by parenteral means and the most convenient manner thus far described is to prepare solutions of the drug; this to be given along with other fluids either by hypodermoclysis or venoclysis. The dosages do not vary from the established ones for other conditions. Complete, careful and frequent observations must be made for symptoms and signs of any toxic effects that the drug may produce and if seen, the drug is to be discontinued immediately.

Very enthusiastic reports have been published recently concerning the use of various sera in the treatment of appendicial peritonitis. All figures given show a remarkable decrease in mortality and as a result, its use in the future will probably be more widespread. Two different groups of sera have been used, both with equal success. Both are to be given early in the disease for best results. In the first group are a polyvalent anaerobic serum, a colon bacillus serum, and a complementary serum against streptococci, staphylococci and other common organisms. The first of the three is given in a dosage of 40 cc. and the other two are given in dosages of 20 cc. each. This may be given intravenously, intramuscularly and subcutaneously or poured into the peritoneal cavity, and may be repeated as often as is thought necessary. The other group consists

of perfringens antitoxin plus a peritoneal convalescent serum. As far as could be determined, both work well and either can be used with good expectations.

Oxygen therapy as routine in the treatment of this disorder has become more extensively used and no longer has the rule of an emergency measure to be used only as a last resort. This is a fortunate and beneficial change. It is especially valuable in cases where distension has already taken place and as a result there is a decreased vital capability. However, it also serves as a combatant to the toxemia present and its resulting lowered red blood count and has been shown to promote absorption of gas from a distended intestine. Furthermore it lends comfort to the patient and as a result reduces apprehension. The latter is a never-to-be-overlooked phase of any toxic state and must be dealt with in the same manner as any demonstrable pathology.

One author highly recommends the use of intravenous 5-10% alcohol, having as the basis for this procedure that it is readily oxidizable and therefore provides a ready source of energy. 30% is needed for hemolyzing effect and this can be readily avoided. Moreover, he states that the effects of alcohol as when taken per os are almost entirely eliminated. This work needs further study before absolute appraisal can be made.

Pitressin, physostigmine and any other drugs increasing intestinal tone are used routinely by some to prevent distension and paralytic ileus. Their value is also of an unknown quantity as too few reports have been received. However, the rationale is logical. Calcium solutions are also used for physiological reasons unknown, but based on the fact that with improvement there is a rising blood calcium and that the actual introduction into the body may therefore have some beneficial effect. The rule of some of the supplementary drugs in treatment of appendicial peritonitis has not been worked out as extensively as desired and much remains to be seen as to their proper place in this complicated problem.

The complications arising from peritonitis include these attendant upon both immediate and late residuals, the more common immediate ones being pneumonia, residual abscesses, pyelephlebitis and paralytic ileus. The most important of the late complications is mechanical ileus. For the purpose of the present discussion, consideration will only be given to ileus, which is the most feared, due to both difficulty in treatment and the high mortality rate which is seen once it has become established. Approximately 75% of all deaths resulting from peritonitis are the direct result of paralytic ileus and therefore its symptoms, signs and treatment must be recognized and understood.



The symptoms and signs are best pointed out by comparing and contrasting those present in mechanical and paralytic ileus. In the former there is a recurrent colicky pain in contrast to the diffuse constant pain of paralytic ileus; the onset of the latter is more insidious; there is a silent abdomen absolutely devoid of peristalsis in adynamic ileus in contrast to the hyper-peristalsis of dynamic ileus; vomiting of fecal material and constipation are present in the dynamic group; greater distension is found in the paralytic type; increased prostration of the patient is seen earlier in the paralytic group and the onset occurs much earlier in the paralytic group (two to four days) than in the mechanical group, which usually is seen after the acute process has subsided and may even be first noticed months after apparent recovery.

The gastro-intestinal tract loses its tone and contractibility powers in paralytic ileus, resulting in distension of its walls. Distension in turn leads to an interference with the blood supply, allowing for decreased absorption and causing an increased secretion. As a result of this disturbed peripheral circulation, a "toxemia" is produced, depending in part on the necrosis of sections of the intestinal wall that has occurred. The decreased absorbing powers of the intestine causes an accumulation and this added to the loss of peristalsis gradually leads to excessive distension. Products

produced in the intestinal lumen at this time that are absorbed are thought to be "toxic" in nature, furthering the general weakened condition of the body. Thus a vicious cycle is set up which is difficult to combat.

Treatment of this condition, with one exception, is entirely medical. Firstly some attempt at decompression must be made, the best and most obvious form being accomplished by use of siphonage apparatus, preferably going to the duodenum or beyond. Distension is relieved by virtue of removal of intestinal fluids and gasses. Once again, the importance of using this measure prophylactically and not therapeutically is mentioned, as a large percentage of cases of paralytic ileus will be avoided if this device is properly used. Secondly, drugs are used to increase intestinal tone-- the purpose here being very obvious. Among those used are pitressin, hypertonic saline solution and morphine. Oxygen is a very important part of the schema as it helps in gas absorption from the intestinal tract and also is comforting to the patient who at this time has a decreased vital capacity, due to a pushing up of the diaphragm by the enlarged abdominal cavity. Hot stupes are comforting, but of no known value. Beyond these devices, one often has to pursue a course of watchful waiting and merely sit by while nature takes its course.

When dealing with mechanical ileus, surgical intervention is absolutely necessary in order to free the adhesions or to anastomose two parts of bowel proximal and distal to the point of obstruction. This does not have to be treated as an emergency, however, and full steps should be taken to stabilize the patient's body chemistry before surgery is undertaken.

The one possible surgical procedure to be used in treating the latter is cecostomy or enterostomy. By this method, it is hoped that decompression will take place. However, it has been shown in recent years that with a paralyzed intestine, no passage will take place, as there is no propelling force and stasis will continue in spite of providing an outlet. Thus its value is very questionable. There are proponents of the idea that routine cecostomy or enterostomy should be done at the time of initial surgery as a prophylactic step to prevent paralytic ileus. This is undoubtedly of some value, the only arguments being raised against it being that excessive manipulation in the abdominal cavity is contraindicated and that as long as the bowel is functioning, no such steps are needed. Whatever may be the reader's opinion of this procedure, he can well hold, for confirmation or refutation of the value of this surgery has not been fully established (prophylactically speaking), but it is not a very widely used



operation, especially since the more recent spread of siphonage drainage apparatus.

In surveying just a mere handful of mortality statistics and results as published by various authors, one is immediately impressed with the marked variation of mortality and morbidity rates. Almost all papers are written with the express purpose of bringing out improvement in results, this holding for both operative and non-operative methods and therefore evaluation is difficult. Figures are always difficult to analyze since the many variable factors are not given. Among the many variations are time of admission after the first symptoms appeared, age of patients, pre and post-operative care, nursing and medical facilities, type of bacteria, character and extent of the peritonitis, and whether or not a cathartic has been taken. Mortality rates vary from less than 1% to over 40%. The important point in this regard is that there has been a decreased rate of deaths, showing that treatment has been more effective. It is interesting to note in this regard that the sharpest declines have been noted when treatment has been changed from immediate surgery to deferred surgery. Where surgeons have revised their methods, it has been in this direction in most cases and very much less often from the deferred to the immediate type of surgery. As has been previously mentioned, the most

common cause of death is general peritonitis complicated by paralytic ileus. Among the other more common causes of death are pulmonary complications as pneumonia and emboli, infection of operative wound, cardiovascular complications and mechanical intestinal obstruction.

When analyzed with regard to age groups, it is found that children under ten and adults over fifty have the highest mortality rates, with the age group between twenty and thirty being the lowest. The older adult group naturally has more fatalities due to pulmonary and cardio-vascular causes. Children on the other hand are not prone to these complications, but have increased mortality percentage for other reasons, these being:

1. Later diagnosis-- the physician in charge too often regards a "belly ache" as gastro enteritis and treats it as such, using such dangerous devices as cathartics, which cause an increased number of perforations and increased percentage of deaths of those with perforations.
2. Lesser development of the omentum which prevents localization of the infectious process and thereby increases the possibility of a diffuse peritonitis.
3. Increased use of purgatives. This has already been referred to and in a large number of cases, the responsibility lies in the hands of the innocent mother whose home remedies are too often tried before a physician is called.
4. Greater procrastination before surgery is done on an acute uncomplicated case of appendicitis. The physician is too often unwilling to definitely make a diagnosis of acute appendicitis on a child and is willing to wait for later developments. Thus he increases the chances of perforation.

In summary, we find that in spite of all the advances made in the treatment of appendicial peritonitis, the mortality rate is still high and that there has been an increasing number of deaths per year in this country as a direct result of appendicitis. The explanation to such a paradoxical situation is not difficult to find. Many of the answers lie in the explanations given for the increased mortality in children, but there are others to be considered. The haphazard and indiscriminate use of cathartics is by far the most dreaded of all vices that keep the incidence and mortality at the high plane which is still prevalent today. Failure to make an early diagnosis and lack of confidence in an early diagnosis is another humbug that causes the gravity of the situation to remain at this serious level. Careless use of morphine, medical procrastination and incorrect or faulty pre- or post-operative diagnosis or care are further factors that cause continuation of an "appendicitis problem." Most of these explanations fall in that group commonly described as being within the radius of human error and therefore are not readily condemnable. Where then can we help to solve this problem? The answer lies in the fact that the best treatment of any condition is the prophylaxis of that condition. Education of the laity and

medical profession of the potential seriousness of abdominal pain will bring both these groups to a common understanding and will make earlier diagnosis possible. Furthermore the absolute warning against attempt at self-medication, especially against the use of purgatives when a person is seen with abdominal pain will be an absolute and practically fool-proof method of preventing early perforation or high mortality in face of perforation at any stage. Only careful and well planned campaigns to attain these goals will show any results. The best and earliest place to begin is in the grade and high schools, for by early education only will the next generation be able to help to accomplish such an ambitious program. We thus see that medical science has made and will continue to make strides that allow nature to exert its greatest influence, but we cannot forget that nature too has limitations on its achievements and that the best way to coöperate with this force is to allow it to work at its best and not when subjected to marked disadvantageous factors.



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