Taxis produces rupture first of the peritoneal coat and then of the inner layers of the receiving bowel. Traction upon the entering bowel tears it. If force is used there may also be a tearing off of a segment of the bowel from its mesentery. It is very seldom that the impossibility of further reduction is due to adhesions. If this was the cause separation of the adherent layers might aid in reduction. The congestion of the entering loops of bowel and mesentery, very often complicated by marked enlargement of the mesenteric lymph nodes, prevents further progress. The parts of the bowel are so swollen and stiff that they fit together like the parts of a dissected puzzle. One usually finds under such circumstances that no actual reduction has occurred during the manipulation, but that the tumor has merely been crowded back into a shorter length of the receiving bowel.

Immediate resection is the step which at once suggests itself and there can be no question that in adults and in older children this should be done. Circumstances may determine whether it should be done through a lateral incision or by the more usual methods. In infancy, however, we are met by the fact that resection is practically always fatal. I know of but two successful cases of resection in children under a year old. Clubbe in an early case in his series, occurring in 1896, resected four inches of bowel. The child was much collapsed, but finally recovered. Frank, in the *Annals of Surgery* for 1903, also reported a successful resection of the cecum in a baby of seven months.

It seems at the present time, in view of these facts, useless to perform in infants an operation which is almost absolutely certain to prove fatal.

What alternatives are offered? The first is the formation of an artificial anus or the insertion of a tube just above the obstruction.

This seems on the whole to offer the best chance of saving life. By doing this the intestinal obstruction is relieved. The harm due to the obstruction may be prevented. The absorption from whatever fecal matter may be in the bowel is prevented. The vomiting incident to this is avoided and the exhaustion of continued vomiting is eliminated. The intussusception still remains. There is a chance that it may be cured spontaneously by sloughing of the entering part, something not uncommon in adults. There is, of course, the danger of death from peritonitis or from general sepsis during the process. But the risk is no greater than the risk from immediate resection.

While I do not know that the step has ever been taken deliberately, if the condition of the patient warrants further interference, the sloughing of the entering bowel might be assured by ligation of its mesentery just as it enters the receiving loop, as Dr. Codman has suggested. The step would be similar to that taken in resection done through an incision in the side of the receiving loop, but it could be done without any opening or further handling of the bowel. It would be a procedure intended solely to assure sloughing of the intussuscepted bowel.

Another alternative is the incision of the constricting ring of bowel just at the point of entrance. Theoretically, an incision made here through the two outer layers of bowel just at the point of entrance and on the side away from the mesentery would allow reduction of the remaining portion just as the incision of the constricting ring allows the reduction of a strangulated hernia. The practical difficulty encountered, however, is greater. The congestion of the bowel makes it very stiff and unyielding. The result is that, instead of unfolding as one would hope, the stiff and damaged, if not actually necrotic, mucous surface of the most advanced part of the mass turns itself out through the incision, infecting the entire field and leaving the damaged bowel of questionable vitality still to be dealt with. Resection then is more difficult than at first. Treatment of the entire mass outside of the abdomen offers no better chance than immediate formation of an artificial anus.

There is one other difficulty occasionally encountered. Owing to the drag of the mesentery the mass becomes so twisted that the point of entrance is practically out of reach behind a tight band of mesentery. The complication is mentioned, but it need have little influence in determining treatment. The ligation and division of the mesentery of the entering loop may, however, expose the point of entrance. Sloughing of the entering bowel, of course, must follow, unless it is resected. If this seems unwise an artificial anus may be made and the conditions are exactly as have been previously described.

Roth remarks (*Der Kinder Arzt*, April 7, 1905, xvi, no. 4, p. 73) that when disinvagination fails all other methods are practically useless. Nevertheless, at the present time this hopeless condition repeatedly confronts the surgeon. It must remain for the men in general practice not to allow the condition to go on so long as to be hopeless.

REMARKS UPON INTUSSUSCEPTION, WITH A SUGGESTION FOR A NEW METHOD OF OPERATION UPON CASES IN WHICH REDUCTION IS NOT POSSIBLE.

BY E. A. CODMAN, M.D., BOSTON,
Assistant Visiting Surgeon, Massachusetts General Hospital.

I RECENTLY had the pleasure of taking part in a discussion at the Medical Improvement Society after listening to a most interesting paper on "Intussusception," by Dr. James S. Stone.

I believe that Dr. Stone has done a great service in bringing up this subject and showing that the mortality in this vicinity from this disease is much greater than it should be. He has shown us that the blame does not lie wholly with the surgeons but with the lack of the common knowledge among practitioners in general of the important early symptoms of intussusception. This disease, at any rate among infants, has such characteristic symptoms of onset that it should be almost invariably, instead of rarely, diagnosed within the first twenty-four hours. It is not appreciated how important is the difference

between operating in the first twenty-four hours, when the child is not "sick," and operating on the second or third day when evidences of shock have set in. I hope that Dr. Stone's paper will lead others, as it has me, to read Clubbe's remarkable monograph on this subject. The chapter on "Diagnosis" should be read by every practitioner. If it could be widely known in the community I am sure that intussusception would be found to be a much more frequent disease than is now supposed. Clubbe has shown that 80% of those operated in 24 hours can be saved and that many cases which die undiagnosed should be saved. At the risk of repetition of Dr. Stone's paper I feel that the following quotations from Clubbe express very well the emphasis which is to be laid on the association of a sudden attack of pain followed by bloody mucus in the stools a few hours later:

"The general appearance of the child is, I feel sure, frequently the cause of mistakes in diagnosis being made by many men. Children in the early hours (six to twelve) of intussusception often do not look sick. Men cannot bring themselves to believe that these healthy-looking, and perhaps laughing, babies can have intestinal obstruction. Yet such is often the case. The child at the first onset turns pale, looks very ill, and screams; but it is wonderful how quickly some of them recover themselves. They cry only at intervals, when they get the gripping pains, as the intussusciptions

make fresh attempts to force along the intussusceptum."

"The mother thinks nothing of the sudden screaming of the child, or of its turning pale; perhaps she has forgotten all about it, until you remind her by your questions. Babies often scream and get pale and vomit, and the mother thinks nothing of it. But directly she sees blood in the motion she knows something is wrong, and hurries off to a doctor as soon as possible. When you are told by a mother that her child has been passing blood, you should always ask certain questions before you send it away. If you are told that the child was quite well until a few hours ago, when it screamed, turned pale and vomited; that it has been fretful and has vomited a few times since, and that it has just passed some blood, you can be morally certain that you have a case of intussusception to deal with; and instead of sending the child away after ordering it some castor oil, you must proceed to verify your diagnosis by careful examination. An extraordinarily large number of cases with this perfectly clear, straightforward, definite history are missed and so only come into hospital when the chances of their recovery are of the slenderest."

The subject has interested me so much that I have read over the records of the cases operated on in the last eleven years at the Massachusetts General Hospital. The accompanying tables of

CASES OF INTUSSUSCEPTION AT MASSACHUSETTS GENERAL HOSPITAL, 1897 TO 1907, INCLUSIVE.
INFANTS UNDER ONE YEAR.

No.	Date.	Initials.	Age.	Portion intestine.	Duration	Operative procedure.	Result.	Remarks.
1	Sept., '97	W. L.	7 m.	Small into large	3 days	Resection. Immediate anastomosis with Murphy button	Died at once	
2	Feb., '98	L. H.	1 m.	Small into large	2 days	Resection. Immediate anastomosis (lateral).	Died at once.	
3	July, '98	A. A.	6 m.		3 days	Reduction by enemata (?)	Recovery	Diagnosis doubtful.
4	Oct., '98	A. O'R.	5 m.	Small into large	3 days	Laparotomy. Reduction	Died at once	Very feeble.
5	July, '03	A. C.	5 m.	Large into large	24 hrs.	Laparotomy. Reduction, but coats torn	Died at once	
6	Sept., '03	J. P. B.	8 m.	Small into large	36 hrs.	Enterostomy, two-stage method	Died at once	Second stage not completed.
7	Oct., '03	F. J. N.	4 m.	Small into large	3 days	Lateral anastomosis without resection	Died at once	
8	June, '06	J. G.	7 m.	Small into large	24 hrs.	Laparotomy. Reduction	Operative. Recovery	Four weeks later operation for hernia. Death.
9	Oct., '06	A. M.	6 m.	Small into large	24 hrs.	Resection. Double enterostomy	Died at once	
10	April, '07	A. N.	10 m.	Small into large	4 days	Laparotomy. Reduced with difficulty	Died at once	
11	May, '07	F. C. G.	7 m.	Small into large	36 hrs.	Resection. Double enterostomy	Died at once	

CASES OF INTUSSUSCEPTION AT MASSACHUSETTS GENERAL HOSPITAL, 1897 TO 1907, INCLUSIVE. — *Continued.*
ADULTS AND CHILDREN OVER ONE YEAR

No.	Date.	Initials.	Age.	Portion intestine.	Duration	Operative procedure.	Result.	Remarks.
12	June, '97	J. D.	25 y.	Small into small	2 days	Appendectomy; then median incision and reduction	Recovery	One year later operation for obstruction. Death.
13	Sept. '02	H. McC.	24 y.	Small into small	3 days	Resection. Immediate end-to-end anastomosis	Recovery	
14	Mar., '03	G. B. F.	22 y.	Small into large	1 hr.	Resection. Immediate end-to-end anastomosis	Operative. Recovery	Death three weeks later. Complications.
15	April, '03	J. M.	3 y.	Small into large	Less than 24 hrs.	Laparotomy and rectal inflation with air. Reduced.	Recovery	
16	May, '03	R. F.	6 y.	Small into large	24 hrs.	Resection. Immediate end-to-end anastomosis	Died at once	
17	Sept., '03	M. A.	11 y.	Small into large	4 days	Laparotomy. Reduction had occurred under ether	Recovery	Pre-operative diagnosis, appendicitis.
18	Feb., '04	R. G.	6 y.	Small into large	12 hrs.	Laparotomy. Reduced by traction.	Recovery	Pre-operative diagnosis, appendicitis.
19	Mar., '04	M. F.	38 y.	Large into large	14 days	Resection of intussusceptum. Enterostomy	Recovery	Successful anastomosis later.
20	Mar., '05	C. L.	4 y.	Small into large	12 days	Artificial anus in two stages. Not reduced	Operative. Recovery	Lived two weeks.
21	May, '05	A. G.	3 y.	Large into large	40 hrs.	Resected. Double enterostomy.	Died fifth day.	Child does not look especially sick.
22	Dec., '05	J. W.	16 y.	Small into large	6 days	Laparotomy. Reduced. Enterostomy	Died at once	Appendix also removed.
23	June, '06	P. D. S.	13 y.	Small into small	6 days	Resected. Double enterostomy	Died at once	
24	July, '06	M. E. C.	28 y.	Large into large	3 days	Partly reduced, partly resected. Lateral anastomosis	Recovery	Both operations at once.
25	Dec., '06	A. A.	27 y.	Large into large	8 days	Resected. Double enterostomy	Died on fifth day	Death from peritonitis.
26	Dec., '07	W. T. D.	43 y.	Small into large	5 days	Mesenteric ligation. Enterostomy	Operative. Recovery	Died after secondary operation.
27	Dec., '07	A. J.	27 y.	Small into small		Resected. Double enterostomy	Recovery	Still in hospital after anastomosis.

these twenty-seven cases reinforce many of Dr. Stone's points and show that the mortality among infants under one year is as great as at the Infants' and Children's hospitals.

In reading these records I have been struck by the great difference in character between the disease as it presents itself in infants and in adults. In young children it is singularly uniform in its characteristics and the diagnosis has been perfectly clear, while in adults the symptoms are most varied and the diagnosis has seldom been made until the abdomen was opened. For instance, the classical symptom of blood in the stools was almost always present in children and absent in adults. It is interesting to see that where the child was brought in early the symptoms are

similar to those described in the above quotation from Clubbe.

CASE VIII. J. G. "Onset sudden with crying, vomiting, pallor and distressed look in face. Previously had been well and bowels moved regularly; twice on day before. Onset twenty-four hours before admission; bowels moved repeatedly after beginning symptoms, but only small amounts of bright red mucus came away. As distress and bloody stools continued patient was sent to the Massachusetts General Hospital for operation.

"Examination: Healthy-looking baby of seven months. Heart and lungs normal. Abdomen soft, tympanitic, no rigidity or spasm. Mass felt in left side of abdomen which had visible peristalsis. Rectal examination showed mass high up."

In most instances where the case came in late the more striking symptoms of shock and obstruction are recorded and the characteristic symptoms of the first day when the child was not "sick" are forgotten.

The case histories of H. McC., M. F. and W. T. D. illustrate the difficulty of diagnosis in adults. The absence of blood and the persistence of fluid stools are found in many adult cases. In case XIX the patient was kept in the hospital several days before operation was done.

I have separated these tables arbitrarily at one year. The change from the infant type to the adult type is by no means fixed, but it may be said that in all infants under one year the disease has a characteristic and rapid course, while in older children and adults it may or may not have a more protracted character. The influence on the prognosis and mortality is obviously great.

I think that a consideration of these tables reinforces Dr. Stone's point that we must look to the general practitioner for help, but it is obvious that even where we have received the case within 48 hours we have not much to be proud of. Although most of Clubbe's cases have been operated in the first 24 hours, he has been able to save many cases after twenty-four hours and a considerable number after forty-eight hours. Even if the general practitioner learns to recognize these cases at his first visit, many mothers will not call him on the first day and others will refuse to consider operation until the child shows serious symptoms.

The object of this paper is to consider what may be done even in very sick cases. That there is a great choice in this matter is shown by the variety of procedures that have been recorded in these 25 cases:

1. Enemata alone,	1 case
2. Laparotomy and taxis plus rectal distention with air,	1 "
3. Laparotomy and taxis; abdomen closed,	7 cases
4. Laparotomy and taxis; wicks to prevent recurrence,	1 case
5. Partial reduction and partial resection,	1 "
6. Resection of intussusceptum,	1 "
7. Resection and immediate end-to-end anastomosis,	4 cases
8. Resection and immediate lateral anastomosis,	2 "
9. Lateral anastomosis without resection,	1 case
10. Resection with anastomosis at second operation,	1 "
11. Double-stage enterostomy without resection,	2 cases
12. Single-stage enterostomy without resection,	1 case
13. Resection and double enterostomy,	6 cases
14. Enterostomy and ligation of mesentery without resection,	1 case

Besides these procedures Mikulicz has suggested stitching the intussusciens to the abdominal wound before opening it and resecting the intussusceptum.

Barker suggests stitching the outer coats of both portions at the neck before opening the outer coat.

Kredel suggests enterostomy and tying the mesentery in bad cases to assist nature to discharge intussusceptum per anum.

There are also other methods more or less modified from these.

Intussusception is so infrequent that each surgeon at the Massachusetts General Hospital is only likely to meet one or two cases in ten years. As the above 27 cases were operated on by fifteen different surgeons, it is not remarkable that fourteen different methods were employed. The indications of each case must vary to a certain extent, but within certain limits more uniformity of method might be reached. For instance, Clubbe employs practically the same method in all cases with far better results than we have. His method is this: A forcible oil enema under anesthesia, followed by laparotomy and taxis. Only once has this been tried at the Massachusetts General Hospital and this time it was successful. (Case XV.) Clubbe's series of successful cases entitles his method to a trial. He must not be understood as recommending enemata *versus* laparotomy. He expressly states that the enema should be given but once and then by the surgeon himself. The patient should be on the operating table with everything in readiness for immediate laparotomy. The object Clubbe hopes to attain is partial reduction which may aid him when the abdomen is opened. No time should be wasted with enemata, especially without anesthesia.

In comparing our 27 cases to Clubbe's 124 one notices at once the great disparity in the number of times resection has been performed. In 124 cases Clubbe only met with 6 which he could not reduce, while of our 27 more than half were irreducible. He evidently believes that the risk of a difficult reduction is less than that of resection, and in doubtful cases prefers to go on trying to reduce. His personal skill must also account in some part for this as well as his method. This personal skill must be discounted when we are considering what is the best method for the general surgeon to pursue in difficult cases. It is obvious that in our series the operators as a rule feared that prolonging the shock by further efforts at reduction was of greater danger than resection. Some fearing to do either simply did enterostomy and left the intussusception *in situ*. Necessarily, in any case which is not perfectly simple, the operator must reach a point at which he must decide in which of these three ways (*i. e.*, forcible effort at reduction, resection, or enterostomy) he had best tax the patient's remaining strength. When this question for decision arises it may be well to remember the procedure adopted by Dr. W. B. Conant in the following case, which he has most kindly permitted me to report:

W. T. D. Age forty-three. Dec. 9, 1907. Massachusetts General Hospital. He has never had a previous attack like this — in fact he has always been well and strong. Five days ago had a sharp attack of abdominal pain in the right lower quadrant. "Did not pay much attention to it and tried to get the best of it." Two days ago pain became very much more severe and was accompanied by persistent vomiting which to-day has been fecal. His bowels moved last night and although it was a good and free movement it was stained dark brown and he thought it contained blood.

Examination: Pale, emaciated, feeble-looking man with peritonitic facies. Abdomen greatly distended and rigid. Hyper-resonant throughout. Somewhat

more tender in right lower quadrant than elsewhere. Temperature, 101°. Pulse, 120.

Operation: Took ether badly. Low right rectus incision. Free blood-stained fluid in abdomen. Mass in right iliac region which consists of ascending colon in which the cecum and an uncertain quantity of ileum is invaginated. Irreducible. Advancing point not determined. *Tight band of impacted mesentery ligated and divided.* Mixer tube tied into ileum. Seat of operation walled off with wicks so that neck of mass is practically outside of abdominal wall. Sent to ward in almost moribund condition.

Dec. 10. Improving but no drainage through enterostomy tube.

Dec. 11. Enterostomy began to drain.

Dec. 13. By careful traction the house surgeon, Dr. Burnett, withdrew 15 in. of necrotic ileum from the neck of the mass. The ends were divided in sound tissue with the cautery and enterostomy tubes tied in.

Dec. 15. Attempt made to suture ends of bowel together in the wound.

Dec. 20. Operation. Ether. Attempt made to anastomose small and large intestine.

Dec. 22. Fecal fistula, but gaining.

Jan. 17. Operation. Another attempt at anastomosis.

Jan. 18. Death.

Obviously this operation of Dr. Conant's ultimately failed, but I believe it demonstrates several extremely interesting if not important points.

Having been able to watch the case at the operation it was perfectly plain to me that the patient's wretched condition would not have permitted either resection or more forcible efforts at reduction. That enterostomy alone would not have done as well was probable, because of his improved condition on the first day, although the tube did not begin to drain until the second.

It shows that tying off the blood supply of the intussusceptum is likely to so shrink it as to allow removal by gentle traction, at least as soon as the fourth day.

My personal experience with intussusception is confined to two infants, in which I have assisted other surgeons to operate, and two cases, one in a child and one in an adult (No. VIII and No. XIII), on which I have operated myself. I have also been fortunate enough to see the operations on Nos. I, XVII, XIX, XX, XXV, XXVII of the cases in this series.

Although the number of these cases is small they presented a considerable variety and have given me a fair opportunity to judge of the difficulties of each method of procedure. Brief reports of my own cases follow.

CASE XIII. H. McC. A man of twenty-four years was brought to the hospital on Sept. 22, 1902, by Drs. Pratt and Babcock, of Dedham. He had been well until three days before when he was seized by a sudden sharp pain in the epigastrium followed by nausea and vomiting. Pain had been very severe at intervals until the last twenty-four hours. He had vomited abundantly during the three days and vomited twice in the accident room after admission. The vomitus was dark greenish but not fecal. The bowels had moved several times but no blood had been seen. The patient was in poor condition. Temperature 101°. Pulse 134. Respiration 30. The abdomen was somewhat distended

and was tender in the right lower quadrant. In the right iliac fossa could be felt an irregular indefinite mass which was dull on percussion and exactly resembled an appendix "cake." Rectal examination: Tenderness in whole pelvis, especially to right.

I had no question that the case was one of appendix abscess and operated through a Harrington incision. On opening the peritoneum blood-stained serum escaped. The mass proved to be an intussusception of the ileum with its lower end about 6 in. above the ileocecal valve. The mesentery was long and twisted once on itself so that the condition was practically one of volvulus as well as invagination. The mass was about one foot in length and was bent with the ends in contact and resembled a huge chocolate-colored Vienna roll.

I had very little difficulty in delivering it through the wound and excising it. I then did an end-to-end suture and closed the abdominal incision, leaving a small drain. The operation took an hour and a quarter and at its end the patient's condition was bad, with a very poor pulse of 150. His condition was very poor for several days and there was slight sepsis in the abdominal wound. Otherwise, his convalescence was normal and when heard from a year later he was perfectly well.

CASE XVIII. R. G. A well developed girl of six years was brought to the hospital on the evening of Feb. 28, 1904. The mother said that in the forenoon the child began to have abdominal pain. The pain had persisted through the day. There had been a small constipated movement in the morning but no blood had been noticed. There had been no vomiting. Previously the child had always been well. Examination was negative except for the abdomen which was full but not distended. In the region of the appendix there was a definite tender mass the size of a small pear. The mass was movable and easily felt as there was no muscle spasm although considerable tenderness. Neglect of a rectal examination was probably the cause of my again making the same error in diagnosis as in the previous case.

Supposing that I was operating on an early acute appendix which was wrapped in omentum but still movable, I opened the peritoneum through a Harrington incision. The mass previously felt proved to be the upper end of an invagination in the ileocecal region.

Instead of reaching across the abdomen to find the lower end and pushing it backwards as most writers advise, I began milking the cecum and at the same time gently pulling the ileum out. A large amount of small intestine was thus easily reduced. Fearing that the condition might recur I left two wicks in to promote adhesions in the ileocecal region. Convalescence was normal except for more or less difficulty with distention. The child was seen recently and has had no recurrence.

I should be ashamed to record my mistakes in diagnosis in these cases were it not that the records of most of the adult cases show similar errors and, as I pointed out before, the absence of bloody stools is the rule in adults. The neglect of a rectal examination in this or any other acute abdominal condition is inexcusable, however. Should I again meet such a case as my first one I should feel that immediate anastomosis was unwise and should prefer to wait for a second opportunity after the obstructive symptoms had been relieved by excision and double enterostomy. There would be no question of considering Dr.

Conant's operation in such a case where excision was easily accomplished. In fact, in cases which involve the small intestine alone it would seem to me that excision and double enterostomy would always be the operation of choice unless, of course, reduction is easy. Dr. Conant's operation is particularly to be considered where the upper end of the mass is at the right iliac fossa, whether only small intestine is invaginated or whether the caput ceci is drawn in with it. In this region the blood supply is best arranged for it.

Where the large intestine alone is involved the risk of tying the mesentery would probably be greater than either resection of a portion as in case XXIV or the procedure adopted by Dr. Elliot in the following case:¹

CASE XIX. M. F., age thirty-eight. March 20, 1904. Massachusetts General Hospital. Had always been well up to two weeks ago when he began to have 10 to 20 movements a day. His bowels had previously been perfectly regular. The loose movements contained no blood. He has had constant pain in the right side of the abdomen. At times this pain would disappear for a few minutes only to reappear. It was at no time very severe. He has vomited a good deal during this period and has retained but little food. He has not vomited any blood nor passed any by rectum.

Examination: The patient is markedly emaciated but states that two weeks ago he was not. Abdomen moderately distended and exhibits considerable muscular spasm. Superficial veins distended. Lower part does not move with respiration. On left side running into flank is a visible oval tumor at about the level of the umbilicus. This seems to move up and down, apparently from peristalsis. The tumor is firm, more or less indefinite in outline, though approaching an S-shape, and rises from the left lower quadrant toward the umbilicus and then down toward flank. It seems somewhat doughy and is slightly movable up and down. The whole abdominal wall is tense but there is no area of especial tenderness. Tympanitic throughout except over this tumor. No shifting dullness. Rectal examination negative except shows intestines pushed down into pelvis. No feces in rectum.

March 21. Under free catharsis and enemata the patient's abdomen has gone down considerably. Stools are not remarkable, etc. Large bowel distended with water (capacity, 5 pints) showing on anterior abdominal wall two and one-half coils of large intestine (*i. e.*, sigmoid). Position of mass and outline to percussion are not changed by injection, and no gurgling through intestine immediately under tumor can be heard, etc.

March 24. In last day or two patient's condition is not quite so good.

March 25. Operation by Dr. J. W. Elliot. A large vertical incision over tumor. The tumor mass was incised longitudinally and found to be an intussusception. The intussusceptum was pulled out through the incision in the intussuscipti and removed. The longitudinal incision in the latter was partly closed and the cut end of the proximal bowel partially sutured to it making a practical enterostomy with a Mixer tube.

The patient did well and gained strength rapidly so that on May 24, 1904, Dr. Elliot was able to do a successful end-to-end anastomosis.

The specimen was composed wholly of large intestine.

This procedure is practically the same as that described by Barker. It has to recommend it as

¹ Annals of Surgery, July, 1905.

against total excision the fact that in the large intestine it is mechanically easier, for tying off the mesentery of a large area of the large intestine is always difficult and dangerous and produces a good deal of shock. Also it avoids the sacrifice of the outer coat. In cases in which the large intestine alone is involved this method seems safer than Dr. Conant's. Possibly, if Dr. Conant's procedure proves successful in ilio-cecal cases it might be tried in such cases as Dr. Elliot's, but the arrangement of the blood supply does not seem so well adapted to it in the transverse colon. Cases that start in and about the ilio-cecal valve are evidently the most favorable for it.

The accompanying diagram illustrates how readily the ilio-cecal supply lends itself to ligation. If one started to tie the tense part of the mesentery of the intussusceptum, which is always felt as a distinct tight band running to the neck of the mass, he could not possibly do harm to the blood supply of the rest of the small intestine if he kept the coils to his right hand and divided the mesentery reasonably close to the bowel. The main trunk of the superior mesenteric must always be found running from its origin straight to the neck of the mass and its branches to the small intestine given off on the opposite side. The ilio-colic

FIG. 1. Diagram illustrating main arches of blood supply of intestines. It is intended to show that one need not fear to divide the impacted mesentery. Even if the division were made as deep as the tie represented on the main trunk of the ilio-colic artery (which would be very unlikely) the anastomoses on each side would protect the rest of the bowel. In other words any division to the left of the line *a b c* would be safe even if the point *c* be carried up the small intestine in the direction shown by the arrow, which is equivalent to the disappearance of more and more small intestine into the large. The essential part to divide would be that part supplying the neck of the tumor, but it would probably be impossible to isolate this and certainly foolish to waste time in trying to. Possibly, experience with this method of operation will lead to some details which will allow the operator to pick out the important portion of the intestine to sacrifice.

The main point to which it is desired to call attention is that the operator need not fear to clamp and tie any portion of the tight band.

artery has two branches, one of which anastomoses with the colica dextra, and thus ligation of any portion of it would still leave a blood supply

to the ascending colon even as far back as the cecum. Before further discussing Dr. Conant's operation, I should like to suggest the following slight modifications of it:

1st step. Division of the small intestine between clamps just above the mass.

2d step. Clamping the tight band of mesentery as close to the mass as possible.

3d step. Tying mesentery on proximal side of clamp in bundles as large as safety permits and dividing bundles between tie and clamp after the application of each tie. This process to be continued until the blood supply of the outer coat is reached.

4th step. Mixer enterostomy tube tied into proximal end of intestine and another into distal end. Both tubes connected with rubber tubing and allowed to drain over side of table.

5th step. If practicable the clamp might be removed from the distal portion of the mesentery so as to allow the venous blood to drain out and thus diminish the size of the intussusceptum.

6th step. Packing the wound in such a manner that the ends of the intestines may be readily manipulated, leaving ends of bowel long enough to try anastomosis later.

7th step. When the drainage from the intussusceptum through its lumen or through its veins have sufficiently diminished its size it may be drawn out of the intussusciens by gentle traction. This would occur immediately or within a few days.

8th step. When sloughed intestine is drawn out, if the patient's condition permits, an immediate anastomosis (perhaps without ether) may be considered. If not, the tubes can be tied in again.

FIG. 2. Showing the arrangement of the wound at the end of the operation. a, the enterostomy tube connected with the distal portion of small intestine. b, the tube connected with the proximal end, the mesentery of which is preserved. The upper clamp holds the divided mesentery of the intussusceptum. This clamp might be loosened to allow venous bleeding, provided the retreating angle of the undivided portion of the mesentery were held by the lower clamp. The only danger of bleeding would be from the anastomosis of the colica dextra. The ends of intestine are left long to facilitate an early attempt at anastomosis, or at any rate giving an opportunity to tie in the enterostomy tubes a second and perhaps a third time. At each dressing the upper clamp can be gently pulled to see whether the intussusceptum has become softened enough to remove. The retreating angle where the small intestine and the mesenteric band disappear in the cecum is carefully walled off with gauze packing.

In considering any operation on intussusception we must first consider the factors producing the serious symptoms. These are in the order of importance: shock produced by the condition; shock produced by the operation; toxemia from fecal obstruction; absorption from septic surfaces; intra-intestinal hemorrhage.

To begin in reverse order with these, *intra-intestinal hemorrhage*.—In none of the records in this series was it even considerable. It usually consisted of blood-stained mucus rather than any real loss of blood. In selecting an operation it need not be considered, for it would be relieved by any of them.

Absorption from septic surfaces.—This may be a factor of some importance, but I doubt if it is very great for the following three reasons: First, in reading the records I found that the description of the excised specimen rarely alluded to extensive gangrene. The intussusceptum was usually hemorrhagic and occasionally showed points of beginning gangrene but never a purulent condition. Second, cases, especially children, may be in very bad condition and even die and yet have the invagination reducible and viable. Third, when nature brings about a cure the only way is by gangrene, and this takes place inside of mucous surfaces which would not absorb readily, especially in a catarrhal condition.

Toxemia from fecal absorption, in other words, the symptoms of intestinal obstruction.—Some writers believe that this factor is of great importance in this as well as in other kinds of intestinal obstruction. I think this is very doubtful even in other kinds of obstruction, for there is always the element of shock to be excluded and these patients usually keep their small intestine clear by excessive vomiting. No matter if the intestine is absolutely empty ligation or other form of complete obstruction will produce the well known acute exhaustion, and *vice versa* when obstruction is only partial as in mega-colon or severe constipation there may be only slight symptoms. In intussusception we have not only the shock from the constant efforts at peristalsis of the intestine to overcome the obstruction, but also that from the constant pulling on the mesentery of the intussusceptum.

The shock of the operation.—That this is a most important factor is shown by a glance at this series of cases, particularly among infants. Even if reduction be accomplished a large abdominal incision must be made, the intestines must be roughly handled and pulled outside the abdominal walls and the mesentery will be dragged on. The same is true of resection.

The shock of the condition.—This is really the important factor. In a child where this does not exist, much manipulation and even excision of large portions of the intestine may be successfully accomplished, but where the intestines have been struggling for days to overcome the obstruction, where each wave of peristalsis has tugged on the impacted mesentery and each wave has produced an immense spasm of pain, no wonder that even the added shock of an easy reduction occasionally

produces collapse and death. If this, the shock of the condition, is the important factor, the primary object of the operation should be to relieve it, just as it is in cases of ovarian cyst with a pedicle, or torsion of any other viscus.

It seems to me that mesenteric ligation as outlined above offers a way of relieving immediately the shock of the condition and at the same time overcoming the obstruction, with a minimum amount of operative shock. It can be done in a few minutes through a comparatively small wound with perfect surgical cleanliness. It offers a hope of allowing a successful extra-abdominal anastomosis four days after the first operation.

It has three great disadvantages: (1) It sacrifices a considerable amount of small intestine and possibly a little of the cecum. (2) It necessitates a second serious operation. (3) It might lead to absorption from the gangrenous bowel before the latter could be removed.

Against these it can be contended that: (1) large portions of the small intestine can be resected without serious consequences; and at any rate, not so much is sacrificed as in resection of the whole mass; (2) a secondary intestinal anastomosis, though a serious operation, has a fair prognosis; (3) that the bowel is likely to be pulled out before dangerous absorption can take place.

These arguments and counterarguments will have to be decided by each individual surgeon in each individual case. To my mind the balance is strongly in favor of ligation when compared to resection in such cases as I, II, III, VI, VII, IX, X, XI, XVI, XX, XXI, — the last two especially.

I can see no argument in favor of simple enterostomy as in cases XX and XXI, for the condition which is causing the shock is allowed to continue although the violence of the straining is abated by relieving the obstruction. Ligation of the mesentery seems to me as important in irreducible intussusception as is ligation in cases of twisted ovarian pedicle.

On the other hand, ligation, when compared to reduction, whether or not aided by enemata, is a very different matter. In early easy cases there would be no question that reduction was preferable; in late cases if we knew they were irreducible there would be no question that ligation was preferable. The trouble is that we never know how much force we must use to bring about reduction, so that there is a large middle class of difficult but not hopeless cases where we must put our trust in one or the other. The decision must be influenced by the condition of the child. My belief is that ligation will be found to give less shock than a difficult reduction, but Clubbe's remarkable series of successes makes it almost unjustifiable to abandon his method except in evidently irreducible cases.

From my personal consideration of this subject I should feel that the following conclusions were justified:

I. All cases in infants and children, in which the diagnosis can be made and which are not already very feeble, should be given one forcible oil enema under an anesthetic on the operating

table. This should be followed by laparotomy whether the tumor disappears or not.

II. Before using efforts at reduction forcible enough to cause increased shock, the surgeon should, *if he does decide on it*, make up his mind to carry out reduction up to the limit of the patient's strength.

III. If reduction is considered too doubtful, resection with double enterostomy is the choice when (a) the mass is wholly composed of small intestine; (b) when it is wholly composed of large intestine and the mechanical conditions make resection easy.

IV. If reduction is abandoned and the mass is wholly composed of large intestine and resection cannot readily be performed, excision of the intussusceptum is indicated by Barker's or Mikulicz's method.

V. In irreducible cases in which the small intestine is invaginated into the large, simple enterostomy without resection and resection of the mass should be abandoned and replaced by ligation of the impacted mesentery and enterostomy.

VI. In infants where there is already evidence of severe exhaustion, ligation and enterostomy could probably be done very rapidly and with less operative shock than even a successful reduction, provided the operator from the beginning abandoned any idea of reduction.

The essential object of the operation which is here suggested is to produce gangrene of the intussusceptum *in a convenient manner* so that within a few days enough softening of the constricted portion will have taken place to allow of its ready reduction by gentle traction. When the arterial supply is cut off it cannot be long before the blood and edema in the intussusceptum will be squeezed out by the peristalsis of the intussusciens, leaving the submucosa still strong enough to stand a gentle pull. The suggestion is offered particularly for desperate cases to replace resection and hopeless effort at reduction. *It would be easier, quicker and produce less shock than any other form of operation.*

Since writing this paper my attention has been called to an article by Kredel in the *Mittheilungen a. d. Grenzgeb. Med. u. Chir.*, Vol. 12, 1903. This author suggests ligation of a portion of the mesentery with the idea of assisting nature to pass the tumor per anum. He also does an enterostomy. The operation is identical with that of Dr. Conant, except that the result aimed at is different. The disadvantage is that it does not give the surgeon the control of the time of removing the intussusceptum, and the gangrene is allowed to go on to a much more dangerous stage. It does have the advantage, however, that in case it is successful it would leave the intestine united behind it as in cases where spontaneous gangrene has occurred, and in this way save a second operation. Kredel had only tried it once and was unsuccessful.

AFTER a long contest the Maryland State Senate, March 19, passed a bill preventing Christian Scientists or faith healers from practicing in Maryland without the diploma of regular physicians. — *Med. Record.*