prove necessary to give small enemas as well as doing manual evacuation of the bowels.

Later one should attempt to break free from these methods. In most cauda-equina lesions, anyway in those who have a dischezia, that is a complete paralysis of the intestines, such measures may be permanently necessary. In severe distension it is possible to bring relief to an exceptionally full intestinal tract, by giving digestive fermentations.

In the early phase, but also at the onset of secondary illnesses, the ileus and near-ileus produce increased difficulties from time to time. In such instances one should give varied doses of Prostigmin, and Pantothen acid, in combination, in carefully balanced infusions, for specific treatment. In rare cases it is necessary to drain the contents of the stomach and duodenum, and reintroduce sufficient fluids, by a stomach tube.

Very few paraplegics can manage for long without requiring laxatives. Bowel-training carefully carried out, can however reduce these drugs to a minimum. Drugs which act on the large intestine are preferable, such as aloe, senna, or acorus oil. Phenolphthalein and associated preparations have a similar action. Whereas these drugs have a special effect on the mucous membrane, we may in other cases obtain results by using laxative salts, such as those contained in mineral water, or with absorption-resistant sugar-alcohol.

The use of liquid paraffin should be limited to special cases because of the disorders of fat absorption.

The action of these various digestive remedies can be accompanied by small doses of so-called 'softeners' (Dioctil-Natrium-sulfosuccinat).

A clear understanding of the picture of the digestive functions presented in paraplegia, careful assessment of the existing state, and specific therapeutic methods make it possible to regulate existing disorders of function.

BOWEL TRAINING

By H. L. FRANKEL, M.B., M.R.C.P.

National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury

THE object of bowel training is regular and complete evacuation of the bowels at a chosen time and place, avoiding any leakage or bowel action in between, while at the same time avoiding constipation. The physiology of colonic, rectal and anal activity has been reviewed by Guttman (1959), Connell, Frankel and Guttman (1963) and Melzak and Porter (1964) and will not be described in this paper which deals with practical aspects of bowel management in patients with complete lesions of the spinal cord of cauda equina. Successful training is possible in almost every case if the doctor, nurse and patient understand the problems and know the methods of management available.

In the immediate stage after spinal cord injury there is often a period of slight or even absent activity of the small intestine; this ileus if recognised soon enough can be treated with regular injections of prostigmine during the first two or three days; we rarely need to pass a tube into the stomach and give intravenous therapy even in patients with cervical lesions and most patients can start a light diet by the third day; on the fourth and fifth day a mild laxative is given followed by

glycerine suppositories and a digital evacuation of the bowels. In many cases these methods will not result in any bowel action and an enema is given.

Giving an enema to a paraplegic is a difficult procedure. In a normal person a tube can be inserted into the rectum and the fluid—saline or soap solution—run in quite quickly, being retained in the rectum by the voluntary contraction of the anal sphincters. As the pressure rises fluid fills the entire colon, as can be seen on a normal barium enema. If the same procedure is used in a paraplegic only a rectal washout is given. If this procedure is repeated several times it may stimulate a bowel action, but anyone who has attempted to give a barium enema to a paraplegic will know that by this technique only the rectum is filled. There are two techniques available which may succeed in a paraplegic; the first is by running the fluid into the rectum very slowly—by means of a drip filling at about 100 ml. every 5 minutes with the foot of the bed raised. The second method is to try to insert the tube into the sigmoid colon. This is a skilled procedure which should be performed only by a doctor or an experienced nurse. This method is particularly valuable in a patient with a flaccid lesion. If a digital examination is performed on such a patient the rectum is often cavernous and somewhere in the 'roof of the cave' the invaginated sigmoid colon may be felt—hanging rather like the cervix of the uterus. Abdominal massage often causes that segment of the colon to relax temporarily and the enema tube can be inserted into the sigmoid colon, after a few minutes this segment contracts on to the tube and a colonic enema can be given. I consider an enema given with the anus plugged to be dangerous, as very high pressures may result.

During the first few weeks after injury laxatives and digital evacuations will almost certainly be required; these digital evacuations should be preceded by glycerin suppositories and should be performed carefully and gently; if undue violence or stretching occurs during the phase of spinal shock the anus may be over stretched and the onset of 'automatic defaecation' may be delayed or prevented.

After the stage of spinal shock attempts are made to teach the patient 'planned defaecation'. The reservoir for faeces is the sigmoid colon and not the rectum. The rectum should be empty except immediately before defaecation. The ability of the sigmoid colon to act as a reservoir seems to be unimpaired in the paraplegic, it is the awareness of faeces passing into the rectum and the ability to assist or prevent their further passage which is lacking. As the last line of defence against faecal incontinence is permanently lost, our efforts must be directed to preserving the remaining function, *i.e.* the holding function of the colon. This can be done by completely emptying the sigmoid colon by appropriate stimulation at regular intervals and by ensuring that the rectum is also completely emptied.

At a later stage a mild laxative is taken on alternate evenings—senna is as good as anything. The smallest dose which has been found to be effective is used, the best time to take the laxative is determined in each case by trial and error. The laxative should 'load the gun and take off the safety catch, but should not pull the trigger'. The final stimulus should be one which can be accurately timed and in most cases glycerin suppositories are suitable, they stimulate and lubricate; the time between insertion and evacuation of the colon is usually 10 to 20 minutes. Dulcolax suppositories are sometimes more effective but may take one to two hours to act. A number of accessory methods of stimulation may also be used the most important being the utilisation of the gastro-colic reflex, abdominal straining or abdominal massage and rectal stimulation with the finger.

In patients with upper motor neurone lesions when the rectum is filled from above it usually empties itself reflexly and completely, and in such patients digital evacuations are rarely required if the patient waits long enough.

In patients with lower motor neurone lesions the sigmoid colon will still empty itself into the rectum when stimulated. Although the patient may be able to expel some faeces from his rectum by straining, in most cases some faeces are left in the rectum. As the anal sphincters are lax there is then faecal leakage, so most of these patients need to remove some faeces digitally.

Having emptied the colon and rectum completely, the rectum should remain empty until the colon is stimulated again two days later. This is only a general plan. Every patient needs individual advice and much depends on previous bowel habit, neurological lesion and degree of motility. There are a number of things which can disturb this method of management, the most important of which is constipation. The method I have described depends on the delivery of a moderate amount of formed stool—neither too hard nor too soft to the rectum. If a considerable length of colon is loaded with hard faeces liquid faeces may be forced past the stale faeces and cause spurious diarrhoea. Constipation is the main cause of diarrhoea in paraplegics. In such cases a faecal softener such as Dioctyl can be given followed by larger doses of laxatives and by enemas.

The second cause of failure may be due to a change in diet or activity. Patients confined to bed may need larger doses of laxative. This is probably due to inactivity rather than to inability to sit on the lavatory. We attempt to teach most patients to have their bowels open on a lavatory but this is largely for social convenience. I do not think that the sitting position is of great importance to the act of defaecation, lying on the side with legs flexed is also effective.

Intrathecal alcohol blocks cause immediate profound constipation which can usually be overcome by further training but in some patients with high cord lesions who have had an alcohol block constipation is a lifelong problem.

The results of adequate bowel training are most gratifying. It prevents ill health due to constipation and avoids social embarrassment. The success of the method is shown by the fact that although the necessity to interfere with his own bowel function is at first most distasteful and embarrassing to a new patient, very few patients who attend for check-up report any serious difficulty and the colleagues and friends of most paraplegics are unaware that these patients have any dysfunction of their bowels.

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Discussion

Sir Ludwig. This introduction into the pathophysiology of bowel action is important to anyone concerned with the treatment of paraplegics and I do not need to tell you what a difficult problem it can be. But, what Dr. Connell has told us has really opened our eyes in quite a number of ways and from all the facts he has shown there is a lot we have to think about.

Ascoli (Italy). I think it is important to take into account that the intestinal function is a typical cyclical function, and this we must remember in the treatment of constipation of the paraplegic. After two or three months, we have the habit of suggesting to the patient to force himself every day at the same time to defaecate. This is very important, naturally with the aid of laxatives or suppositories, but the important thing is to take into account that it is a cyclical function, and we must try every day at the same time to empty the bowel.

Benassy (France). In paraplegics we have two problems. In the upper motor lesions, we have only few troubles with the bowels. Some patients usually empty their bowels every two days and the best result is when they do it 20-30 minutes after breakfast. Can we explain why most of them go every two days? The drug we use most in France is a vegetable one. But the greatest difficulty we have is with the lower motor neurone lesion, and patients who have only very little locomotor trouble are often the worst with the bowels, especially when there is only little paralysis of the muscles of the foot, *i.e.* lesions below the second sacral roots. When these two roots are eliminated there is incontinence of the bladder and rectum and impotence, and where only one is involved the patient can usually go to the toilet and when in sitting position can empty the bladder and bowel simultaneously, and we could not find any treatment for such condition.

Walsh (England). I was sorry to hear Dr. Frankel say that most patients with low lesions need digital evacuation. I think this is true to some extent, but I have noticed more and more patients who come as new lesions to us and are treated from the beginning can do without this. I think it important they should, for in many cases it can often lead to anal fissure. With regard to the question of haemorrhoids in relation to constipation, I do not think it is the constipation but the time spent on the toilet. I inject an awful lot of haemorrhoids but very rarely in cervical lesions, most of whom have their bowels opened in bed.

Sir Ludwig. The development of haemorrhoids particularly in lower cord lesions and cauda equina lesions is an increasing problem. To a good deal this is due to the way the patients empty their bowels. Quite a number use digital evacuation, and, if they are not careful, especially if they do it without gloves, they produce damage to the mucosa and produce fistulae, and the result is vasodilation and the development of haemorrhoids, which many become a very great nuisance. One can, of course, succeed in most cases to control them by injections, but in some, one has to do more extensive operations.

The second point I want to make is this. I think it was Dr. Connel who pointed out the individuality of bowel action in normal people. This is a point everyone who has anything to do with paraplegics has to take into account, and this, I am afraid, is something which is overlooked. In every case of paraplegia who is admitted to hospital, one should find out and write into the notes their bowel habits before the paraplegia, and one might find most interesting things. We have amongst our patients people who had the habit of opening the bowels only once a week. In such patients we have precisely the same condition as in patients who drink a lot and pass urine only once a day, thus developing distension of the bladder. The rectum and colon in chronic constipation become overloaded and the contractile function of these areas becomes less and less. If in addition to this local deficiency a neurogenic lesion occurs, we are not surprised that these people may have greater difficulty in defaecation as compared with those who had emptied their bowels regularly daily. Every case should be examined very carefully. For some years I have, in co-operation with Dr. Frankel here and with Dr. Thomas from my unit in Cardiff, made systematic barium meal studies and these have revealed some interesting conditions. We have also to consider congenital abnormalities of the bowels and in particular enteroptosis which may play an important part in the dysfunction of the bowels.

Another point to be considered is the technique of enemas which have to be done very carefully; sometimes this is left to an orderly who is not very familiar with a proper technique. He may use, for instance, too hot water, and as the paraplegic patient is insensitive this can result in a very nasty burn. We had such a case some years ago. In high lesions, one must also be careful not to produce overdistension of the bowel, especially in cases with lesions above T₅ which may elicit the now well-known distension syndrome of the autonomic system. Although this, as a rule, is not as pronounced as in bladder distension, it is certainly present in those cases due to marked constipation resulting in cardio-vascular responses including hypertension.

I want to ask what has been the experience on the effect of antibiotics, in particular after prolonged application, on the bowel function? We have found here that this has some effects but we have not really examined this problem in detail and I wonder whether some of you have already had experience.

Connell (N. Ireland). In reply to the question raised by a colleague earlier as to why it was that patients had such a good response after breakfast, some interesting work had recently been done which seems to indicate that the gastro-colic reflex is not in fact a reflex at all but rather a humeral effect. This, if confirmed, would mean that this particular response would not be disturbed in any way in the paraplegic, except as far as the end organ may be modified.

Sir Ludwig. Why is it that some people claim that when smoking a cigarette on the toilet the bowel action is improved?

Connell. It is very often psychogenic, but it may be that initially there is a definite pharmacological effect of the nicotine on the guts. I have some records which show very dramatically the effect of smoking on the bowel, so possibly initially smoking may be effective pharmacologically but latterly it is the calm soothing effect that this situation may have.

With regard to your question about antibiotics, I think that antibiotics are probably dangerous if one is thinking in terms of their use for relief of constipation. There is no doubt that many of them, in particular neomycin and tetracycline, do cause a loosening of the bowel, but this is at the risk of having an overgrowth of some dangerous organisms. The type of preparation which is useful in altering bowel flora I feel is something like a non-absorbed sugar material, lactulose which is not split in the small intestine; it will pass down to the colon and there will promote an overgrowth of lactic bacillus and other lactic fermenters and these in turn will lower the pH. of the stool which is a stimulus to bowel movement. These preparations have been used in normal persons who are constipated. I have no experience in paraplegics but I think they are worth trying.

Weiss (Poland). I would like to ask a question about the possibility of reversing your experiment. Perhaps we can activate the function of the intestines by giving the patient such a capsule and by stimulating through electric contractions that work in an artificial way. What do you think about such a possibility?

Connell. This is, of course, a delightful idea. Unhappily, we are dealing with smooth muscle and not skeletal muscle, and all experiments so far attempting to reproduce the normal contraction of smooth muscle electrically have failed. There have been various devices used in the duodenum, pace-maker devices, in an attempt to overcome ileus, but unhappily it looks as though these present experiments are not helpful. We will have to do much more work into the electrophysiology of smooth muscle at a basic level before we are in a position to reproduce the activity of the bowels.