

UNDERSTANDING THE FUNCTION OF THE SMALL GASTRIC POUCH; APPLICATION TO POST-OP TEACHING AND EVALUATION

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INTRODUCTION

From our earliest experiences in bariatric surgery, we have been intrigued with the question "How does our operation cause weight loss and maintenance?" As we talked to the public, and even our medical peers, it became evident that a common concept of the uninformed is that the small gastric pouch simply mechanically restricts intake, preventing the post-op patient from eating too much. Indeed, superficially, it may appear that way especially in the first 3-9 months post-op. However, even a short experience with following our patients shows us that with a meal size of even three to five ounces, certain patients will stop losing weight and start to regain. We also note that two to five or more years postoperatively certain patients seem to have a large meal volume of six to ten ounces but still maintain good weight control without an noxious degree of hunger. It has become clear with experience that the principle of weight control is the achievement of satiety, or the absence of abnormal hunger, associated with the ingestion of the appropriate number of calories sufficient to meet the person's need. If adequate satiety is achieved, our patients are successful. . . And they fail if that satiety is not achieved. When patients "fail" there is a tendency, even among bariatric surgeons, to pass it off as "noncompliance." Certainly, this can be an appropriate evaluation in a few persons who are not willing to accept responsibility for the lifestyle changes necessary to make the small gastric pouch function properly. But, is this the problem for the majority? I think not. When failure does occur, it is usually the inability to maintain the post meal satiety long enough to prevent snacking before the next meal time arrives. Also, it could be due to ingestion of a large number of calories in a form that is somewhat hidden to the patient and is not responsive to the gastric pouch restriction, especially high calorie liquids.

HYPOTHESES OF POUCH FUNCTION:

At this point in time what have we learned about how the small gastric pouch works? In the form of an hypothesis, we can now state that the basic mechanism is that of stretch of the pouch walls with eating of a small meal, or even the drinking of fluid. This stretch is sensed by the stretch receptors in the pouch wall and relayed by neural pathways to the appetite centers in the hypothalamus by way of the tractus and nucleus solitarius. The second hypothesis is that successful maintenance of satiety depends upon the creation and maintenance of a small gastric pouch and a small gastric pouch outlet (Mason- reference 1). The third hypothesis is that the observed increase in functional meal volume over the months and years following a gastric bypass procedure is due to the process of hyperplasia and is not wholly or in great part due to noncompliance on the part of the patient. The fourth hypothesis is that understanding of these principles and effective teaching to a compliant patient results in better weight loss and maintenance than if the teaching is not accomplished.

PUBLISHED DATA

To support these four hypotheses, we have two pieces of reasonably good scientific information from peer reviewed published articles. From that point we must rely on observational-based science.

Our first question is how does the small gastric pouch create satiety? Considerable insight on the neurological pathways of satiety has been obtained through the work of William Barber, a Ph.D. veterinarian, and his associates who published a paper in 1983 entitled "Brain Stem Response to Phasic Gastric Distention." (reference 2) They placed a balloon in the stomachs of anesthetized cats and surrounded the stomach with a strain gauge. Microelectrodes were placed in the nucleus and tractus solitarius of the brain stem. They found a population of neurons that faithfully monitor moment to moment changes in gastric wall tension. The discharge frequency to wall tension did not adapt for the twelve hour period of the experiment. This response was dependent upon an intact vagal nerve in these cats. They concluded that "these neurons may serve as a critical link between the stomach and higher centers in the conscious perceptions of fullness." It seems particularly impressive and interesting that the neurons continued to fire at an accelerated rate for as long as twelve hours, if the gastric wall tension remained high.

Another question of considerable importance to the thinking of a bariatric surgeon is what is the fate of the small gastric pouch? Does it enlarge at all after the surgical procedure? If it does enlarge, is it because the operation

was done improperly? Was it because of gross patient noncompliance and gorging? Or, is it due to the kind of hyperplasia seen throughout the gastrointestinal tract, a response to loss of function? Dr. E. E. Mason, at one of the Iowa Bariatric Symposia in the early 1980's, suggested that it might be useful to ask patients to eat cottage cheese in a structured manner in order to attempt to determine their functional meal volume at different times postoperatively. I took the idea home and began asking all of my patients to do this simple test with each one of their follow-up postoperative visits at three, six, nine, twelve, eighteen, and twenty-four months. We continued to do this over the next decade (and subsequently to date), and figure 1 reveals a regular, progressive, stepwise increase in functional pouch volume over time that strongly suggests the orderly process of hyperplasia. Stabilization occurred at two years at a mean pouch size of six ounces with a wide range of three to nine-ten ounces. The pouch appears to not get larger after the second year. (reference 3) These gastric bypass pouches were created as a vertically oriented, 30 cc pouch measured against both volume and pressure of 70 to 85 cm of water. The curve of pouch enlargement is the inverse of the weight loss curve.

We then proceeded to compare the patients' weight losses at one and three years to pouch sizes at one year. Figure two reveals that there was no difference in percent excess weight loss at one year, with the different pouch sizes within this range of up to nine-ten ounces. We then compared the largest third of pouch sizes to the smallest third of pouch sizes, and still there was no significant difference in weight loss at one year or of maintenance at three years. This finding is, perhaps, the most important result to come from the Cottage Cheese Test work. It strongly suggests that within these limits of pouch sizes that success in weight loss and maintenance depends not only on having a small gastric pouch but even more so in how the patient uses their "pouch/tool." If this is true, then the implication is clear that learning how to use the pouch/tool effectively is important and that it is our responsibility as bariatric surgeons to see that effective teaching is made available to our patients over this two year period of changing intake and satiety control. In brief, the Cottage Cheese Test data tells us that within the context of a small meal volume, lifestyle change including exercise is the most important variable. The stepwise progressive growth in the functional pouch volume (meal size) probably defines the rate of weight loss for the patients taken as a whole, but the degree of weight loss and maintenance for the individual patient is more dependent upon that patient's ability to make the required lifestyle changes: proper use of the pouch/tool and adequate amounts of activity and exercise.

OBSERVATIONAL-BASED MEDICINE

Observational-based medicine has a long history of respect going back to the early work of two of my personal surgical heroes, Andreas Vesalius and Ambrose Paré. Indeed, we often refer to the "art and craft of surgery". Although we do make great effort to have a scientific basis to our surgical decision making, ideally with prospective randomized studies or double blinded studies, at this point in time the majority of what we do is based on empiricism, or observational-based medicine. The observations that I would now like to share from my own personal thirty-three years of experience in bariatric surgery are also shared by many other experienced bariatric surgeons of my acquaintance, although not all would agree with all of these principles.

For the first fifteen years, although I remained busy in a general surgical practice, my primary interest, bariatric surgery, lagged because of the lack of patient material, primarily because of the profound discrimination of medical insurers against the morbidly obese in our area of the country. What appeared to be a disadvantage initially became an advantage, as I thereby had the opportunity to follow almost all of my patients personally during that time. As there was little known about the mechanism of action of the gastric bypass procedure, I spent a good deal of my time thinking about possible mechanisms and observing the differences between patients with good weight loss and those with poor weight loss. Since the beginning, I have performed the short limb gastric bypass procedure (GBP), only adding the malabsorption procedure of the banded gastroplasty/distal gastric bypass procedure (BG/DGB) in 1992. The BG/DGB also uses a small, vertically oriented gastric pouch quite similar to the gastric bypass procedure pouch, the difference being that the outlet is controlled by a band as in the vertical banded gastroplasty and silicone ring gastroplasty, etc., instead of a gastroenteric anastomosis. My observations seemed to be similar for the two procedures, although not identical for both. The Cottage Cheese Test was done only with the GBP. Considering the above, what do I think that I have learned?

The following are observations that may have an effect on the function of the gastric bypass pouch:

1. We have come to understand that the accomplishment of satiety, or suppression of hunger, is fundamental to the success or failure of bariatric operations.
2. We have come to understand that success relates anatomically to creating a small pouch that

remains relatively small and a small outlet that remains relatively small (Mason).

3. Meal volumes much larger than ten-twelve ounces usually result in failure of weight maintenance.

4. The use of the thick, less distensible lesser curve of the stomach is believed to be important by many surgeons.

5. Satiety is achieved by increasing the tension on the gastric pouch wall, thus stimulating the stretch receptors.

6. Maintaining satiety is dependent upon maintaining some portion of that stretch for an undefined period of time.

7. For either the gastric bypass or the banded gastroplasty, almost all patients have a profound satiety, 24 hours a day, in the first six months or so following their bariatric surgical procedure. They do not redevelop a normal appetite preceding the next meal until six to twelve months postoperatively.

8. If for any reason the patient is NPO for a significant period of time like eight to twelve hours, a profound hunger will be experienced.

9. In the mature pouch at one plus years post-op, the more solid of food that a patient eats, the longer is the satiety period after the meal.

10. Almost all patients after the gastric bypass procedure, and most patients after the vertical banded gastroplasty, achieve fifteen to twenty-five minutes of satiety after simply rapidly drinking water to a point of fullness, or "water loading."

11. Some patients fail the banded gastroplasties in association with shifting their diets to mostly liquids or soft solids, the "soft calorie syndrome," and they fail by becoming hungry too soon before their next meal and giving in to snacking between meals because of that hunger.

12. Responsible patients who carefully follow the principles of using their "pouch/tool" continue to have a reliable and progressive weight loss and weight maintenance.

13. Patients who approach or become underweight at one to two years following bariatric surgery can reverse their weight loss with reversing the principles of using their pouch/tool.

HOW DO WE INTERPRET THESE OBSERVATIONS?

POUCH SIZE:

It seems intuitive that the functional meal volume must stay small in order to limit the patient's caloric intake and provide satiety. What is not clear is how small it must remain. The Cottage Cheese Test, discussed previously, gives us some insight. With the data from that test, the pouch size/functional pouch volume can exceed six to seven ounces and still give as good a satiety as a smaller pouch. Obviously, this depends on patient behavior such as choices of specific foods eaten, frequency of meals, fluid management, and last but certainly not least, the amount of activity/exercise.

OUTLET SIZE:

The outlet of the small gastric pouch is a fixed ring, either fixed by scar or fixed by a band or both. There is no longer a valve that controls the rate of emptying. Therefore, it is intuitive that liquidy foods will exit the pouch faster than more solid foods. Certainly, no pouch can control the amount of fluid consumed, nor would it be tolerable if that could be done. Therefore, the calories contained in high calorie liquids have the ability to defeat weight loss or maintenance.

EARLY PROFOUND SATIETY:

The mechanism of action of the profound satiety of the first six months is presumed to be due to the necessity of the patient drinking water very frequently throughout the day in order to meet minimal fluid requirements. From our experience with "water loading," we note that water loading will give almost all patients fifteen to twenty-five minutes of satiety if done when they are hungry. Presumably, the frequency of water drinking during the first six months simply overlaps these short periods of water-induced satiety.

The return of appetite in our patients at about six months correlates with two-thirds of the pouch hyperplasia as determined by the Cottage Cheese Test. The average pouch size then is approximately four ounces when the lesser curve pouch is created at one ounce in volume at 70-85 cm of water pressure. The mechanism of action is presumed to be a less frequent stimulation of stretch receptors in the gastric pouch wall because at this point the patient can ordinarily drink six to eight ounces of water at a time.

OPTIMUM MATURE POUCH:

How might we describe the optimum mature pouch? The pouch seems to work best when one, the outlet is not too restrictive to allow eating of solid foods such as meat and vegetables but two, the outlet is not so large as to allow early emptying and premature loss of satiety from solid food, and three, the pouch is not too large to allow over eight-nine ounces a meal.

IDEAL MEAL PROCESS:

What might be the ideal meal process? The ideal meal process includes timing of meals. To get through the day without hunger on three meals a day, there needs to be about five hours between breakfast and lunch, lunch and dinner, and dinner and bedtime. It becomes evident that if there are only three hours between breakfast and lunch, and then six to seven hours between lunch and dinner, that one cannot expect satiety to be maintained over the full seven hours, no matter how solid the food eaten, short of frank outlet obstruction. For the optimum meal, a more solid type of food such as finely cut meat and minimally cooked or raw vegetables should be eaten. The meal should be taken over five to fifteen minutes, depending upon the functional pouch volume. Stringing a meal out over thirty to forty-five minutes or more is one of the techniques that has been used to "beat the pouch." Following the meal, take no liquids for one and a half hours, or even two hours if satiety is lost too soon before the next meal. Then, after that one and a half to two hours is up, begin drinking low or no calorie fluids somewhat slowly (in order to avoid over load symptoms if there is still considerable food in the pouch) and then progressively accelerate drinking up to fifteen minutes before the next meal. The patient should be urged to drink a lot of water in the two hours or so before the following meal. This period of rehydration ends with a "fluid load" fifteen minutes before the next meal. However, a single pre-meal fluid load can never adequately rehydrate an individual who has not already been drinking a lot of fluid. Fluid loading can be done any time in the two to three hours preceding the meal if hunger is experienced. This use of the fluid load can substitute for taking in unwanted calories through snacking.

THE MANAGEMENT OF PATIENT TEACHING AND TRAINING

Postoperative patient instruction begins with setting appropriate expectations preoperatively through the information provided in your thorough patient information booklet. This is the time to introduce fundamental principles such as: the small gastric pouch is a "tool" to gain and maintain satiety. Most patients have a fairly clear picture that a tool is something that one uses to perform a task but that the tool itself is relatively useless if it is put away on a shelf and not used. Patients also seem to appreciate that developing skill in using a tool will make the tool more effective.

NECESSITY FOR LONG TERM FOLLOW-UP:

We emphasize the need for long term follow up care. It is not possible in most patients to teach a fundamental change in lifestyle in "theory" by written materials given preoperatively or immediately postoperatively. The fine tuning of the teaching of how to use the pouch/tool to prolong satiety is not probably able to be accomplished until the patient redevelops hunger before the next meal, in the sixth to twelfth month postoperatively. Techniques on delaying the return of hunger are simply not relevant to most patients when they are not hungry at all, as they are not in the first six months. Even emphasizing preoperatively the crucial need for long term follow up care does not always result in patients returning as they should, but one must set the expectation for those who will be compliant for long term follow up.

PREVENTION OF VOMITING

We believe strongly in the principle that vomiting should be prevented if at all possible. This teaching begins in the hospital on the second postoperative day when we initially instruct the patients to drink only out of one ounce cups, and to drink only one-third of that ounce at a time with sufficient time between thirds to detect fullness. We emphasize that it is not easy to get used to having a small pouch volume. For the first few months, the patient's mouth will be larger than their stomach, a situation which otherwise does not exist in the mammalian kingdom. Also, we keep our standard gastric bypass patients with their small edematous outlet on liquid feedings for the first six weeks, gradually advancing from totally liquid nutrition such as Ensure supplemented by protein powder up through a blenderized diet and very soft solids. The banded gastroplasty/distal gastric bypass procedure with its relatively generous 7.0 cm band on its outlet is advanced more quickly to soft solid foods by three weeks.

Vomiting seldom occurs in the immediate postoperative period unless there is an outlet obstruction problem. However, vomiting can occur and will do so in most patients at some time after starting on solid food. There are more complexities when eating solid food especially rice, pasta, or granola, foods that swell in the stomach after being eaten because they are generally incompletely rehydrated before being consumed. The most frequent cause of vomiting is overloading the pouch. We encourage patients to continue to measure their meals with their one ounce cups for weeks, even months, following the surgery if they are experiencing difficulty with vomiting. We emphasize repeatedly that they should eat only until "comfortably satisfied" as the word "full" has different meanings to different persons.

SIX WEEKS

Solid food is begun with emphasis on the fine cutting of fibrous food to the size of the fifth fingernail or smaller, thoroughly chewing, three or more foods at each meal to prevent wadding up of similar fibers, eating only until "comfortably satisfied," and beginning, even at this early date, to teach the concept of no liquids with meals for fifteen minutes before meals and for one and a half hours after meals.

REASSURANCE OF ADEQUATE NUTRITION

Many patients need reassurance that they can achieve adequate nutrition in the postoperative period. Without this reassurance, some patients will deliberately eat six to eight times a day because of a fear of malnutrition (often initiated by well meaning family members and friends). We like to point out that in this short period of time during the pouch growth, there are only two major nutritional needs: protein on the one hand and vitamins and minerals on the other. The latter can easily be achieved by the patients routine twice a day use of the vitamin supplements. Therefore, their only responsibility and focus is to eat low-fat, animal-source protein at each meal, three to four times a day. If they do this or simply come close to doing this, they will end their first year post-op with a lower than pre-op lean body mass but one that is appropriate to their body weight at that time. (reference 4)

MEAL SKIPPING

On the other hand, some patients are likely to skip meals when they have no appetite, similar to their behavior previously when their appetite has been diminished by over tiredness or illness. We emphasize the need for three to four meals a day, including breakfast, primarily to meet their needs for protein. We emphasize that one-half or more of each meal should be composed of this low-fat, animal-source protein (two-thirds of their meal in the distal gastric bypass procedures) in the first months until their pouch volume is large enough so that they can eat at least two ounces of protein at each meal.

ARTIFICIAL SWEETENERS:

We warn our patients to be aware of using artificial sweeteners if they are experiencing hunger in this early p.o. period. We have evaluated a few patients who experienced very strong hunger cravings in the first weeks or months post-op whose hunger abruptly ceased with stopping artificial sweeteners.

AVOIDING ABSOLUTES

There are so many rules that we teach concerning the use of the "pouch/tool" that we believe that it is important to emphasize to the patient that it is not necessary to follow every rule all of the time. We actually suggest that it is perfectly all right to break the rules once in a while- the important thing is to be aware that one is breaking the rule and having a reason for it even if that reason is simply alleviating frustration. We point out that the only penalty for eating a liquidy meal when appetite has returned is the earlier return of hunger in the next four to five hour period. There is no lasting effect beyond that next meal. We also point out that deciding to take advantage of a social opportunity to eat a high calorie, empty calorie meal is the ingestion of a relatively insignificant 600 to 1,000 calories instead of the 3,000 to 5,000 calories that could be consumed in such a meal with a normal stomach volume.

THREE MONTHS

At three months we step up the teaching of the nutritional or protein-containing value of foods related to the "cost" of that protein food in terms of calories consumed, i.e. a gram of cottage cheese protein "costs" only five calories, but a gram of cheddar cheese protein costs sixteen calories, and peanut butter twenty-four calories. Water loading techniques (see below) are introduced at three months postoperatively as some patients will begin to see a return of appetite before their six month office visit. Overall fluid management is discussed, emphasizing how the Gastric Emptying Test illustrates the principles of fluid management (see below).

THREE PRINCIPLES FOR GAINING AND MAINTAINING SATIETY

1. The pouch needs to be truly filled with adequate wall distention with each meal (i.e. no snacking).
2. Keep the pouch filled over time and slow down the emptying time (by eating solid foods and avoiding liquids for fifteen minutes before and one and one half to two hours after eating). We understand this to be the most important lifestyle change after the gastric bypass procedure. Figure 3 shows the results of a standard gastric emptying test using radioactive sulfur with a scrambled egg, bread, and milk. With the milk, 90% of the meal volume has exited the stomach within forty-five minutes. However, without the milk, only 45% of the meal has exited the stomach by ninety minutes.
3. Finally, adequate protein with each meal. We emphasize three meals a day including breakfast (defined as the first meal of the day which is eaten within one to two hours after arising). We define the "enemy" as high calorie liquids. We point out that snacking and high calorie liquids cheat the patient because the calories are taken in without offering significant satiety.

FLUID LOADING

Fluid loading is the rapid drinking of a non-calorie or low-calorie liquid on an empty stomach in order to achieve a maximal intake of water at that time and/or achieve immediate satiety which lasts for fifteen to twenty-five minutes. About 80% of the estimated maximum capacity at any given time should be drunk rapidly over fifteen to thirty seconds and then topped off with swallows until full satiety is reached. Patients rather rapidly determine what their capacity is, and it usually is between eight to twelve ounces when the Cottage Cheese Test volume is four to six ounces. The fluids should not be so cold as to be uncomfortable, but it is not necessary to be warm. The mechanism of action is presumed to be the distention of the Roux limb with subsequent contraction, stopping the progression of fluid downwards and backing up the volume and pressure into the small pouch and, perhaps, even into the distal esophagus. Fluid loading works with the banded gastroplasty as well but not quite as effectively. The mechanism here is probably primary distention of the pouch with a fluid as it is passing through. The volume required is usually somewhat greater, but it still is far less than two to four glasses of water required in a normal sized stomach. Clearly, this small proximal pouch is quite sensitive to distention, and the satiety gained from that distention lasts far longer than the distention itself. We teach patients to fluid load before each meal in order to help prevent post meal thirst, but also to fluid load whenever they feel the sensation of hunger and are tempted to snack.

POST PRANDIAL THIRST:

It is important that the patient be fully hydrated before coming to the next meal because the solute load of the meal will create postprandial thirst. It seems intuitive that persons cannot tolerate thirst any more than they can tolerate hunger over the long run as both hunger and thirst are primary noxious stimuli. Initially, when the

functional pouch volume is quite small, the solute load is correspondingly small, and the patient may not see the point of adequate rehydration and pre-meal fluid loading. However, as the pouch volume increases and the solute load increases, it becomes a significant issue in maintaining that important proscription of avoiding liquids during and for an hour and a half after the meal.

URGENCY

In these first months we like to emphasize to patients that their golden opportunity for maximizing their weight loss is in the first six months after surgery. We illustrate this with the weight loss curve, with its rapid downward sweep, with two-thirds of their weight being lost in the first six months postoperatively. The Cottage Cheese Test shows that two-thirds of the pouch growth occurs in the first six months. Therefore, we teach our patients that every day during this early period the exercise and activity that they do will be more effective in burning calories in excess of their calorie intake than the same amount of activity/exercise the following day. . . and a little less effective than the previous day based on progressive pouch growth. I.e. every single day the patient should take advantage of their present opportunity and get as much activity as they can, knowing that never again will that same amount of activity result in as much weight loss. We try to give them a sense of urgency about getting the most out of every day.

SIX MONTHS

At this point, or soon after, our patients are beginning to get hungry before their next meal, and we accelerate the teaching of satiety mechanisms and the prevention of post meal thirst. As the meal solute volume increases, they need to push enough fluids in the two to three hours before the meal to gain good hydration with final water loading fifteen minutes before the next meal.

INTAKE INFORMATION SHEET AS A TEACHING TOOL

At each visit from three months to two years, the patient is asked to complete a form before they come into the office. The form queries them about their performance on the principles of pouch use (as well as vitamin usage, exercise, pathological symptoms, etc.). This form is designed so that it is also a teaching tool- each question reminds the patient about the principles of the use of their pouch/tool. Many, if not most, patients do very well, and their weight loss is progressive and satisfying. Some struggle to make the lifestyle changes necessary, but with these periods of intermittent monitoring, encouragement, and teaching they progressively learn and most do well. A few patients never seem to understand or to remember these simple principles even though they might be quite intelligent, capable persons in other facets of their lives. . .

HONEYMOON SYNDROME

The profound satiety that patients experience in the first six months, along with the rapid weight loss due to intake restriction, can lead certain patients to believing that these circumstances will never change in spite of the clear teaching of our patient information booklet and clinic visit handouts. For these patients, we will then see a slackening off on their food selection and liquid calorie control and see them indulge in more recreational eating. They will cut back on their exercise as they seem to be losing a great deal of weight without exercising. Their weight loss will subsequently slow. We have dubbed this situation the "honeymoon syndrome" and tried to educate our patients, even in our preoperative informational booklet, that they can expect this temptation to occur and that they must not get "suckered" into a false sense of comfort that leads them to not make a sufficient effort in their own behalf and miss this golden opportunity for weight loss. We have found that an effective tool for identifying and reality-orienting the patient is to graphically compare that patient's weight with the mean weight loss of the group as a whole. Whatever the patients beginning weight is, we would expect them to parallel the weight loss curve. If their weight deviates from the expected, we should be able to find a reason for it and to correct it if the patient is willing to learn and make this needed lifestyle change.

EXERCISE

Although this chapter is about understanding the function of the small proximal gastric pouch and how it relates to patient management, a word must be mentioned about exercise. We believe that the scientific data overwhelmingly demonstrates that 1) exercise is a critical part of a healthy lifestyle for patient and doctor alike, and 2) that exercise is necessary to maintain weight loss in the obese patient. Therefore we believe it must be a

critical part of our postoperative patient teaching and encouragement. Exact details are beyond the scope of this presentation, but we do emphasize to the patients that the feelings of vigor and energy are in no way guaranteed by a slender figure. Observations of people on any city street confirm this. . . We emphasize that the release of endorphins with aerobic exercise improves emotional stability and mental clarity and helps any person to cope with the deprivations and annoyances of everyday life. Endorphins, adrenalin, norepinephrine, etc., also act in an antidepressive manner. But most importantly, especially in the first six month period when the gastric pouch is so small, regular aerobic exercise maintains, or even improves basal metabolic rate that is observed to drop during rapid weight loss.

THE IDEAL MEAL FOR WEIGHT LOSS

The ideal meal for weight loss is one-half of the meal volume up to a total volume of two to three ounces of animal-source, low-fat protein plus filling the rest of the pouch volume with low starch vegetables and solid type fruits such as apples and pears. Cut finely and chewed well, these foods represent coarse, solid food choices that are likely to stay in the pouch longer and offer good nutritional value.

VOLUME VERSUS CALORIES

A person with a normal stomach tends to judge how much he/she needs to eat at a given meal by approximately how many calories are in that meal (although not necessarily thinking of calories as such). In other words, we know that we are going to be unpleasantly hungry before dinner if our noon meal consists of a green salad and a couple of ounces of cottage cheese. Calories are what keep us from getting hungry between meals. On the other hand, the post-op gastric bypass patient needs to learn to think about the volume and consistency of food choices rather than their caloric content when judging how to prevent getting hungry before the next meal. **I recall a lecture I once attended in which the lecturer pointed out that one or two sticks of butter could meet our entire calorie needs for the day and could be easily consumed by even the small post-op gastric bypass pouch. However, that same number of calories in the form of non-starchy raw vegetables could not be consumed by a person with a normal stomach in only three meals a day.** * There is an enormous variation between calories and volume, and a patient needs to learn how to "think volume" when making food choices to gain and maintain satiety in a mature small gastric pouch. * *In other words, satiety can be accomplished with the use of the low fat, high bulk nutritional program, without the risk of surgery!*

ISSUES FOR LONG TERM WEIGHT MAINTENANCE

The previous comments are primarily designed to deal with patient issues in the first year following a gastric bypass procedure. These issues should seamlessly slide into long term weight maintenance and, indeed they do so in most persons.

COUNTER-INTUITIVENESS OF FLUID MANAGEMENT:

It is clear that avoiding liquids with meals and pushing fluids between meals is counter intuitive. The large capacitance of a normal stomach is a great convenience factor for that person and, truly, all animal life. There is a resistance to learning this technique, and clearly it is counter intuitive to the experience of the individual. However, if it is important that solid food be taken rather than liquidy food to maintain satiety, then it is clearly important to avoid liquids with meals or soon after meals as the liquid will simply make the food more soup-like and soft and allow more rapid emptying of the pouch and, therefore, shorten the period of satiety.

SUPPORT GROUPS

We have found that support groups are very effective in reinforcing the principles of the pouch/tool use. Many, if not most, patients will explore these principles on their own by using them and then for a time not using them. Some patients on their own become convinced of the value of these principles through this natural experimentation. However, others may lose their way. The support group offers an excellent feedback mechanism for individuals who need reinforcement of the principles of the pouch use. Sometimes, the feedback of their peers is more effective than that of the parental figures in the surgeon's office.

TEETER-TOTTER EFFECT

One "visual" that we use when discussing weight maintenance is that of a teeter-totter. On one end of the teeter-totter is the exercise/physical activities, and on the other end is the meal choice discipline and fluid restrictions. When one has a large amount of exercise and activities, the teeter-totter swings down on that end, and the amount of effort that need be placed on diet discipline lightens up. When one is light on the activity/exercise, one has to be much heavier on the diet discipline side. If one is light on both exercise and diet discipline, the whole teeter-totter moves upward as weight is gained. On the other hand, if one is "heavy" on both exercise and diet discipline, the teeter-totter bar goes down, and weight is lost.

TOO MUCH WEIGHT LOSS

There are a group of patients in our practice, approaching 15%, who lose too much weight in the one to two year period postoperatively. Inevitably, these individuals were only 100 to 150 pounds overweight to start with and are good exercisers. We encouraged them to taper off their efforts with diet discipline (maintaining their exercise routine and thus their vigor) by adding some fat back to their meals and eating a fourth or fifth meal a day with less discipline on the fluid management. Basically, it is an exercise on "how to beat the pouch." The pouch can be beaten by one, liquid high calorie meals; two, frequent meals or grazing; three, eating a meal over thirty to forty-five minutes; four, adding liquid to meals to enhance gastric emptying; five, liquids are taken shortly after eating which increases gastric emptying and decreases the satiety period. Some patients take our advice and taper off their weight loss before they go underweight. However, a small but significant group of patients actually go underweight because all of our patients have experienced the rapid and frightening return of severe hunger cravings when going from one of their many diets to trying to eat normally once again. Very similar to a bear coming out of hibernation, their suppressed appetite center seems to burst out with vigor in order to save the life of this person who the appetite center sees as a normal weight person having suffered in a famine. Many patients at this point have not yet fully accepted that they have had a true anatomic and physiologic change from their operation and that, using the principles of the pouch/tool, a return of this overwhelming appetite will not occur. For these persons, it is not until their lean body mass is effected and they lose their delightful sense of vigor that they will begin to "break the rules" and gain some needed weight back. This is probably the primary reason why, in most bariatric surgical practices, the weight loss curve bottoms out at eighteen to twenty-four months with a rise at two to three years. This rise has been erroneously interpreted as most patients regaining 10% to 15% of weight from the nadir of their weight loss.

BARIATRIC MEDICINE

A much more common problem is that of patients who have not lost as much weight as they would like and are plateauing at a level above their goal weight. Bariatric medicine techniques can be useful in helping our postoperative patients who find themselves stuck on a plateau one or more years postoperatively. However, there can be a problem with standard weight control and dietary teaching of Bariatric medicine. The frequently used recommendations of frequent small feedings or liquid calorie fasts such as a protein sparing modified fast, neutralizes the satiety function of the pouch/tool, and tends to negate the teachings of the principles of the pouch use, and therefore is probably not an optimum way of managing the patient.

SUMMARY

The principles of the postoperative bariatric surgical follow up management are as follows:

1. Understanding the fundamentals of the anatomy and physiology of the pouch/tool.
2. Evaluating the patient's appropriate or inappropriate use of the tool- What is lacking? What is being done well?
3. Instruct patient with words, drawings, analogies, encouragement, and passion, on not only what to do but why it needs to be done.

The goal is to make the patient become fully knowledgeable about how to control their own weight over the long term through the appropriate use of their pouch/tool, combined with a reasonable amount of exercise.

EVALUATION FOR WEIGHT LOSS FAILURE

Evaluating a patient who is progressively regaining weight can be relatively simple- or extremely difficult. The first principle is to determine that the gastric pouch is anatomically intact. If it is not intact, it should be made intact by a revision procedure. Only when the surgeon can be reassured that the pouch is intact does the complex part begin- evaluating how and why the patient is not using the pouch/tool properly, and/or getting a reasonable amount of exercise.

We need to know three things about the small gastric pouch. First, is the staple line intact; second, is the outlet intact; and third, is the pouch reasonably small in size.

The upper GI series with thick barium is the basic tool for evaluating intactness of the staple line and the outlet. If the pouch has been stapled in continuity with the rest of the stomach, we must confirm that the staple line remains intact. An eventration of the staple line will create two gastric outlets leading to rapid pouch emptying, early loss of satiety, and thus early return of hunger. An important clue from the patient's history is the presence of a marginal ulcer after a gastric bypass. Marginal ulcers do occur, occasionally, with an intact staple line. However, they are more common with a small hole in the staple line that results in food stimulation of the antrum. If there is a staple line eventration, the marginal ulcer is unlikely to be able to be controlled without reoperation and closure of that eventration, preferably with complete division of the small pouch from the distal stomach.

The upper GI series with thick barium in the hands of an experienced radiographer can usually give the bariatric surgeon a reliable view of the diameter of the gastric outlet. A diameter of over 18-20 millimeters is usually associated with weight regain, and we term this "outlet failure." Outlet failure, like a staple line eventration, causes rapid emptying of the pouch, early loss of satiety, and early return of hunger.

On the other hand, weight regain can occur as a result of an outlet diameter under 7-8 millimeters which can lead to persistent vomiting of solid foods and gradual persuasion of the patient towards the Soft Calorie Syndrome with resultant rapid pouch emptying, early loss of satiety, early return of hunger, and weight regain.

The upper GI series is less effective for evaluating pouch volume because of the fact that barium is very much of a liquid. To assess pouch volume, you must turn to the patient's history of the size of the meal that he/she can consume within a short five to fifteen minute time frame, and/or to the Cottage Cheese Test (see above).

In the patient whose gastric pouch seems to be anatomically intact and yet he/she is still regaining weight, the evaluation becomes more complex. The usual finding is that the patient is not following the principles of the use of their pouch/tool and/or is extremely inactive physically. There are four problems that occur with some frequency: the patient has never been taught/or does not understand how to use the tool; the patient is significantly depressed; or loss of contact with a bariatric practice and other bariatric patients and a gradual erosion of following the principles; or the patient is truly noncompliant and will not take responsibility for his/her own behavior.

LACK OF TEACHING

An excellent example of the lack of teaching/understanding of how the pouch works is found in the history of GC. GC is a 62-year-old woman who presented in consultation **for a total regain of her weight and complaint of constant hunger, sixteen years following a gastric bypass procedure in Cambridge, Massachusetts.** She stated that she had not seen the surgeon beyond the six week follow up visit. She understood nothing about how to use her gastric pouch. She initially lost fifty pounds and then another forty pounds further with the help of a commercial weight management program. For the next ten years she yo-yoed up and down with the usual peer group and doctor supported programs with a gradual increase in weight and the usual hunger and deprivation syndromes relating to these programs. **She then developed myasthenia gravis** * and her weight regain escalated to her preoperative weight, resulting in the referral. At the time of the referral she was being treated effectively for myasthenia gravis and was reasonably active, being able to walk over a mile at a time. Her weight loss curve with its abrupt turn around and rapid weight loss (figure 4) could be consistent with a revision reoperation. However, there was no revision done. After evaluation of her pouch/tool with an upper GI series and a Cottage Cheese Test/functional meal volume estimation, she was given the basic instructions of how to use her pouch/tool, the same given to all of our postoperative patients. Her ensuing and continuing weight loss is impressive, but more impressive to the patient is that she is not experiencing any distressing hunger cravings, food fantasies, or food dreams as she had experienced with all of her previous efforts, since the first months after her gastric bypass procedure sixteen years ago. * *auto immune disorders after surgery are theorized as possibly caused by afferent limb syndrome wherein the unused portion of the intestinal limb develops an overgrowth of*

bacteria.

DEPRESSION

Depression is a powerful inhibitor of success after bariatric surgical procedures. A small but significant number of our patients have been doing well following their gastric bypass procedure only to drop out of sight for a time and then reappear with a significant weight regain. Upon evaluating these patients, it would appear that in many instances they seemingly deliberately reverse all of their learned principles of the use of their pouch/tool: grazing and snacking through much of the day, drinking high calorie liquids, drinking liquids with meals, and stopping their exercise, even when they are intellectually aware that exercise in itself releases numerous vasoactive substances which act like antidepressants. DB is a 46-year-old woman who had an excellent initial weight loss following a gastric bypass procedure (figure 5). While still in the first year after her gastric bypass, her life, already made difficult by divorce and economic circumstances, became severely disrupted when her only daughter developed a drug problem, an abusive relationship, and finally HIV, and was forced to give up her newborn child. Her weight regain was dramatic. However, even more dramatic was her weight loss once her depression eased, and she was able to look after herself once again. She relates that she did nothing dramatic such as fasting. She simply returned to using her pouch/tool in the manner in which she had been taught and resumed a moderate exercise program.

What can the bariatric surgeon do when patients are obviously depressed and regaining weight? Obviously, the most important thing is to steer them to professional counseling, if they are not already in counseling. Then, the surgeon can be encouraging. We can encourage them to continue to use the tool as best as they can; we can encourage them to return to exercise which will improve the spirits and reassure them that the improvement is "deserved," "because you really are a good person, and you deserve to feel better. . ." Most of all, the surgeon can reassure them that the pouch/tool is not ruined by this overeating and gradual weight regain if it does not result in persistent vomiting of solids. When they are ready once again to use their pouch/tool, it will be there for them, and they will be able to once again lose weight without being hungry.

EROSION OF THE USE OF THE PRINCIPLES:

In a third subset of weight maintenance failure patients, a subtle weight creep can occur to patients who are otherwise compliant, non-depressed, and have intact pouches. The patient will see it as "struggling" with his/her weight, and by definition, he/she will not have seen you in follow up and will have usually lost contact with the support group or other bariatric surgical patients. There seems to be a progressive erosion of following the principles of the pouch/tool use. This may be due to denial as seen in diabetic patients, or it may be due to the influence of their peer group and the fact that some of the principles of the use of the pouch/tool, especially fluid management, are counter- intuitive and counter to behavior of their peer group. The patient will often not come back for evaluation because "I know what I'm doing wrong!" (meaning that he/she is eating the wrong things and too often), and these patients will internalize their "failure" with an increasing sense of guilt which itself acts as an inhibition to coming back to their surgeon's office for help.

From the beginning, in our preoperative teaching, we emphasize the possible need for a "refresher course" in the use of the principles of the pouch/tool at some time in the future. Some patients still do not return. The trick is identifying these patients and somehow getting them back either into the office or into a support group.

In these three examples- lack of teaching, depression, and gradual erosion of the use of their tool, weight once regained can be lost once again if the pouch is anatomically intact and the patient decides to use it, or learns how to use it or relearns how to use it.

In these three examples, we are working with compliant, reasonably responsible persons who, when they can, are willing to take responsibility for their own behavior.

TRUE NON COMPLIANCE:

The most difficult problem is determining, and being comfortable with that determination, when a patient is being fundamentally noncompliant and obstructive. This type of individual may leave your care and go to others complaining about a "personality conflict," or perhaps even that you have not given them the time and attention that they need and deserve. Inexplicably, some will actually stay in your care. In this instance, when the patient tends to return perhaps even more frequently than usual, depression will be more likely the underlying

mechanism rather than noncompliance. It can be difficult to be reasonably sure of what is going on in one or two visits. The truly noncompliant patient will very likely end up with multiple revisions and/or a reversal due to weight regain or complications. This kind of patient is often quite resistant to counseling, but I know of no other management option that offers much hope for success. Luckily, this type of patient represents a very small minority of our patients. Obviously, prevention in the form of patient selection is better than cure, but after twenty-three years of a bariatric surgical practice, I have yet to be able to effectively identify these persons preoperatively. I have, in fact, suspected significant noncompliance in a number of my patients who have turned out to be quite compliant particularly after control of other problems, such as sleep apnea, that effect understanding and complying with our instructions. With the current lack of an effective psychological screening tool to reliably identify these individuals, I tend to lean towards giving each person a chance at a good and healthy life provided by bariatric surgery.

BIBLIOGRAPHY

- 1) Mason, EE, Personal Communication, 1980
- 2) Barber, W, Diet al, Brain Stem Response To Phasic Gastric Distention. Am J. Physiol 1983; 245(2): G242-8
- 3) Flanagan, L. Measurement of Functional Pouch Volume Following the Gastric Bypass Procedure. Ob Surg 1996; 6:38-43
- 4) Rosemurgy, A.

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