

CLÁSICOS EN NUTRICIÓN

Comentario al artículo

Observaciones metabólicas en pacientes con shunts yeyunocólicos

*Payne HJ, De Wind LT, Commons RT
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Introducción

En 1963 se publicó por vez primera un artículo en American Journal of Surgery bajo el título “Metabolic Observations in Patients with Jejunocolic Shunts”, escrito por el Dr. J. Howard Payne y cols¹. Hace 40 años la Obesidad Mórbida ya era una grave e intratable enfermedad para amplios sectores de la población americana y el Dr. Payne conocía que tanto en los estudios experimentales realizados con perros a quienes se había resecaado una parte importante del intestino delgado, como en aquellos pacientes que por diversas causas tenía que haberse extirpado casi todo o partes esenciales del mismo, se había producido una inmediata e irreparable pérdida de peso así como importantes trastornos metabólicos por déficits nutricionales.

Basándose en experiencias y comunicaciones aisladas como la de Victor Henrikson en Suecia en 1952 y las de Linner y Kremen en USA en 1954, en las que se habían resecaado “apropiadas cantidades de intestino delgado” para el control de la obesidad, decidió con sus colaboradores del Departamento de Medicina y Cirugía de la Universidad de Los Angeles, California, iniciar toda una serie de estudios acerca “de la naturaleza básica y tratamiento del Status Obeso”.

La oportunidad les llegó en 1956 en que un grupo de diez pacientes con Obesidad Mórbida, fracasos reiterados de todo tipo de terapias médicas y múltiples co-morbilidades acompañantes (Diabetes, Hipertensión, Enfermedad Hepática o Síndrome de Pickwick), decidieron aceptar la propuesta de someterse a una operación quirúrgica para reducir su peso y, al tiempo, estudiar los efectos metabólicos que dicha intervención podía ocasionarles.

Esta intervención quirúrgica fue catalogada como “a planned jejunocolic shunt”, y consistió en realizar una sección del yeyuno a 38 cms del ángulo de Treitz (15 pulgadas), y anastomosar su extremo proximal a la mitad del colon transversal, con lo cual se excluía casi todo el intestino delgado, el colon derecho y la mitad del colon transversal, aunque sin extirpación de ningún segmento intestinal (fig. 1, dibujo original de Payne).

El propósito emprendido, era completar la restauración de la continuidad intestinal, total o parcial cuando los pacientes alcanzaran lo que consideraban su “peso ideal” (aproximadamente un año después), o antes si los efectos metabólicos secundarios lo hacían necesario. A la intervención se añadía una paniclectomía abdominal, biopsia hepática, renal e intestinal. Si se encontraba indicado se realizaba una hernioplastia umbilical y apendicectomía. El tipo de anestesia utilizado fue la espinal en todos los pacientes menos en uno que requirió anestesia general.

En tres pacientes, la restauración intestinal no se realizó íntegramente, sino que el yeyuno proximal previamente seccionado, se bypassó y anastomosó al ileo terminal a una distancia de la válvula ileo-cecal de

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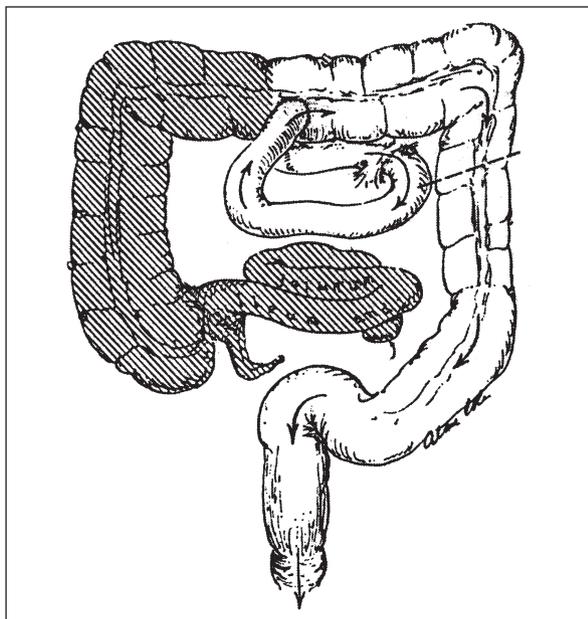


Fig. 1.—Operación final de bypass intestinal. Anastomosis yeyuno cólica.

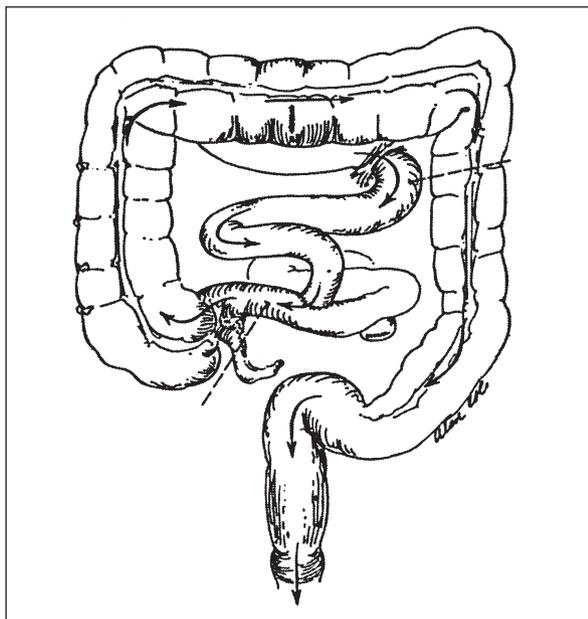


Fig. 2.—Continuidad intestinal restaurada solo de manera parcial. Anastomosis yeyuno ileal.

25 cms, 38 cms y 105 cms respectivamente (fig. 2, dibujo original de Payne).

Una correcta planificación clínico-quirúrgica

El estudio proyectado por el Dr. Payne contó con siete fases perfectamente diseñadas tanto en el estadio

preoperatorio como en el quirúrgico y posterior control postoperatorio, igualando cuando no superando a muchos de los multidisciplinarios protocolos actuales de estudio y seguimiento de los pacientes con obesidad mórbida.

En las dos primeras fases, realizó a cada paciente un “screening” tanto clínico como psicológico junto a un completo estudio analítico que incluía un sistemático de sangre y orina exhaustivos, perfil lipídico, hepático, proteico, bioquímico y hormonal. Son de destacar los test de tolerancia a la glucosa (oral y endovenosa), control de creatinina de 24 horas, excreción de 17 ceto-esteroides y bromosulfotaleína, entre otros. Un estudio de la función cardio-respiratoria y preparación intestinal con neomicina, completaban el pre-operatorio.

Después de realizar el Bypass yeyuno-cólico, un exhaustivo control postoperatorio fue realizado, no sólo desde el punto de vista clínico, sino analítico y metabólico, haciendo un especial seguimiento de la curva de descenso de peso, los niveles de tensión arterial, electrolitos, evolución del calcio y del potasio, niveles proteicos, hidratos de carbono y grasa en relación con la propia evolución del sobrepeso perdido. Un control del recuento hemático, estudio de la función renal y hepática, así como de las propias biopsias obtenidas en la fase quirúrgica, completaban el importantísimo acúmulo de datos y valiosa información no sólo para su propio crucial momento, sino incluso para hoy en día.

En la siguiente fase se volvía a realizar un nuevo estudio preoperatorio y de preparación para la cirugía similar a los ya realizados al principio y una vez completados, se realizaba la reintervención y revisión quirúrgica del Bypass, volviendo a restaurar la continuidad intestinal total en siete pacientes y añadiendo en los otros tres un nuevo Bypass yeyuno-ileal como hemos descrito previamente. Nuevas biopsias hepática, renal e intestinal fueron realizadas, junto a la paniclectomía y extirpación simultánea de cualquier órgano patológico.

Finalmente un nuevo estudio y seguimiento postoperatorio de cada paciente fue llevado desde el punto de vista clínico y analítico al igual que en la fase previa.

¿Cuáles fueron sus resultados iniciales?

La principal característica descrita en el trabajo de Payne fue la significativa malabsorción a las grasas y una “implacable” (“relentless”) pérdida de peso. Los autores indicaban que una dieta rica en grasas incrementaba el tránsito intestinal y los pacientes “lo pagaban” con despeños diarreicos e irritación anal. La media de pérdida de peso al año fue de 55.7 kgs. Y aunque existieron variaciones individuales, la media de pérdida de peso por semana la calculó en mas de 1 Kgr, equivalente a la conseguida en un período de ayuno total.

La tensión arterial se normalizó en todos los pacientes, incluidos los dos enfermos con Síndrome de Pickwick y fallo cardiopulmonar.

No se presentaron cambios significativos en los niveles séricos de sodio, CO₂, fósforo, fosfatasas alcalinas, urea, creatinina y hierro.

Los niveles de potasio bajaron en todos los pacientes a pesar de administrarles suplementos orales e incluso parenterales en cinco pacientes sintomáticos.

A pesar de la absorción alta del calcio, a todos los pacientes se les administró calcio oral y aún así, cuatro de ellos presentaron deficiencias y sintomatología dependiente del déficit de calcio, sugiriendo que la causa podía encontrarse en la falta de absorción de vitamina D.

Los déficits de potasio y calcio, obligaron a una restauración del tránsito intestinal en dos pacientes, antes de que hubieran alcanzado el "peso ideal".

El colesterol se situó en sus cifras normales en todos los pacientes, indicando que los cambios realizados en el hígado podían afectar a la síntesis endógena del colesterol realizada por el mismo.

Los niveles de 17 ceto-esteroides se redujeron significativamente en los pacientes estudiados después del Bypass inicial.

El recuento hemático mostró caídas en los niveles de Hb y eritrocitos, sobre todo en los afectos del S. de Pickwick, aunque los recuentos leucocitarios permanecieron normales.

En todos los pacientes las proteínas séricas y la albúmina descendieron y se alteró el proteinograma de forma significativa, sobre todo en la fracción alfa globulina, aunque la fracción beta fue normal en todos los estudios. Los autores sugerían que la ingesta de dieta hiperproteica incrementaba la diarrea y añadían que una dieta rica en hidratos de carbono, con modestas cantidades de proteínas y grasas, proporcionaban una mas baja excreción de grasa y nitrógeno en las heces, aunque no siempre los pacientes estaban dispuestos a seguir las instrucciones dietéticas prescritas.

El metabolismo de los carbohidratos también sufrió alteraciones importantes evidenciando una curva plana al test de tolerancia a la glucosa y restaurándose niveles normales de glucosa en sangre; por el contrario la distensión abdominal y excesiva flatulencia fue observada en varios pacientes.

Las biopsias renales e intestinales, no mostraron ningún proceso patológico. A nivel intestinal, ni la inspección ni el estudio microscópico identificó anormalidad alguna ni antes ni después del bypass, así como tampoco se evidenció la existencia de ningún tipo de síndrome de asa ciega.

Por último, los estudios de la función hepática, mostraron tanto analíticamente como por biopsia que seis de los diez pacientes mostraban cambios moderados o severos de infiltración grasa del hepatocito, junto con fibrosis periportal, y los otros cuatro, ligeros o sin cambios. Las biopsias realizadas después del by-

pass, mostraron un variado grado de cambio en la infiltración grasa, sin incremento en la fibrosis u otros cambios patológicos, señalando los autores que no existía evidencia de reversibilidad en el cambio de la grasa durante el período del estudio, a pesar de la gran pérdida de peso.

¿Cuáles fueron sus resultados a medio y largo plazo?

La evaluación de resultados en cirugía de la obesidad se considera actualmente que debe superar la barrera de los cinco años para poder considerarlos realmente válidos. En este sentido, el pionero estudio de Payne, a pesar de no ser homogéneo en los plazos de ejecución del mismo, evaluó correctamente a los pacientes entre tres y cinco años después de su primera intervención, excepto en un caso en que la paciente "se perdió" a los dos meses de restablecer la continuidad intestinal total, en otro en que la paciente falleció por tromboembolismo pulmonar (TEP) súbito a los seis meses de su primera intervención y en un tercero en que realizó uno de los bypass yeyuno-ileales y el seguimiento posterior fue de solo un año.

En los pacientes a quienes restauró íntegramente la continuidad intestinal, todos menos uno, comenzaron a reganar peso rápidamente y en los últimos controles, a tres-cuatro años después de su reintervención, habían recuperado todo su peso anterior o lo habían superado, solicitando "desesperadamente" una nueva intervención quirúrgica.

La paciente a quien se realizó un bypass yuyuno-ileal a 105 cms de la válvula ileo-cecal, también volvió a padecer su peso inicial a los dos años y medio del mismo. Cuando el bypass se realizó a 38 cms de la unión ileo-cecal, la paciente reganó parte de su peso perdido y a los dos años se mantenía con 20 kgs por encima de su "peso ideal", comiendo sin restricciones. Solamente la paciente con el bypass a 25 cms de la unión ileo-cecal, se encontraba al año en su peso normal y clínicamente bien, aunque el período de seguimiento fue solamente de un año y por tanto valorable únicamente como resultado inicial.

Complicaciones

Los autores quedaron "gratamente sorprendidos" de que estas "enormes personas", toleraran tan bien los procedimientos quirúrgicos, no hubiera mortalidad operatoria y tuvieran un bajo porcentaje de complicaciones tanto locales como generales: 1 hernia incisional, 1 seroma de la herida, 5 trastornos electrolíticos severos, 2 pérdidas de cabello y 1 tromboflebitis. Los autores no especificaron si estas complicaciones se debieron solamente a la primera intervención o a los dos procedimientos quirúrgicos utilizados en cada paciente.

Además todos los pacientes tuvieron diarrea en diferentes grados con problemas perianales. Casi todos comenzaron con 10-12 deposiciones diarias, que posteriormente fueron reduciendo a 3-5 por día, dependiendo del tipo de alimentación realizada; así mismo, si la dieta realizada incluía un exceso de grasas o hidratos de carbono, el paciente se pasaba casi todo el día en el servicio, al margen de padecer intenso dolor, irritación y hemorragia endoanal.

Los pacientes con déficits de calcio y potasio, no pudieron recuperarlos a pesar de la suplementación administrada hasta que se los reinstauró el tránsito intestinal completo.

Como complicaciones tardías, no se describen mas que un fallecimiento por TEP a los seis meses de la primera intervención. Se desconoce el grado de diarrea u otros trastornos metabólicos que pudieran sufrir los pacientes a quienes se realizó un bypass yeyuno-ileal.

Enseñanzas y comentarios

En términos generales la lectura del estudio realizado por el Dr. Payne y cols., impresiona tanto por el rigor técnico y científico desarrollado en el mismo, como por la honestidad de sus conclusiones. Al mismo tiempo los datos y resultados presentados son de una increíble actualidad a pesar de haber transcurrido mas de cuarenta años y haber sido la primera serie de pacientes documentada en la Historia de la Cirugía de la Obesidad Mórbida.

El acierto estuvo sin duda en aprovechar las experiencias aisladas existentes hasta aquel momento en intervenciones quirúrgicas para la obesidad y en el estudio de las resecciones intestinales masivas y sus repercusiones sobre el metabolismo corporal. Con este bagaje intentó abordar por vez primera un diseño quirúrgico que hiciera frente al terrible problema de los pacientes con Obesidad Mórbida, abriendo el camino a todo el posterior desarrollo de la Cirugía de la Obesidad.

Ahora bien, ¿ por qué realizó el bypass yeyuno cólico a tan solo 38 cms del ángulo de Treitz?...en principio existía el conocimiento de que la mas larga supervivencia descrita por resección intestinal estaba en el mantenimiento de 36 cms de yeyuno; pero quizá la razón fundamental fue el pensamiento inicial de provocar un rápido descenso de peso, eliminar las co-morbilidades y alcanzar el “peso ideal” lo antes posible. Al reinstaurar la función intestinal, los pacientes continuarían manteniendo el peso perdido y por el contrario, normalizarían los trastornos metabólicos derivados del bypass. El “error de cálculo” fue precisamente el desconocimiento de que la Obesidad Mórbida es una enfermedad crónica y que por tanto reaparece inmediatamente en el momento en que los procedimientos quirúrgicos introducidos pa-

ra frenarla o controlarla, desaparecen o son insuficientes.

Sin embargo, la idea original mas válida planteada en el estudio acerca de la restauración intestinal, fue la de mantener un bypass yeyuno-ileal, introduciendo nuevos y muy interesantes elementos al intentar mantener la pérdida de peso y al tiempo un cierto grado de absorción proteica, vitaminas y minerales, con lo que la operación podía en principio considerarse como definitiva y por tanto nos encontramos ante un primer modelo válido de Cirugía de la Obesidad. Este procedimiento se divulgó y realizó posteriormente durante años en todo el mundo como alternativa malabsortiva frente a Obesidad Mórbida.

Lo realmente espectacular de esta parte del estudio es el comprobar que con sólo 38 cms de yeyuno y la misma longitud de ileon terminal, el paciente recuperó una parte importante de su peso inicial y al que anastomosó a 105 cms del colon, recuperó completamente el peso inicial, con lo cual podemos comprobar que los mecanismos de adaptación intestinal, sobre todo en los pacientes con Obesidad Mórbida, son especialmente sorprendentes. Solamente el paciente con el bypass de 25 cms de ileon terminal se mantenía en su “peso ideal” al año de la reconstrucción, aunque desconocemos los efectos secundarios del mismo.

Es obvio que sea precisamente el debate en torno a los procedimientos de malabsorción y exclusión intestinal uno de los temas mas cruciales en relación con la Cirugía de la Obesidad, de cuyas serias consecuencias sobre el metabolismo y otros factores de la conducta humana, ya nos advertían las conclusiones del Dr. Payne y aún hoy día tenemos mas que sobradas lagunas que precisarán de nuevos estudios en estos aspectos del conocimiento y la práctica quirúrgica. Es reveladora en este sentido la afirmación original de Payne de que “ the theory that slimness resolves all problems of the obese patient is seriously challenged by our results “.

La cirugía de la obesidad en el 2005

La Obesidad Mórbida se ha convertido en la actualidad en la segunda causa de muerte prevenible en el mundo después del tabaco y en la primera en los EEUU, estando ya considerada como Enfermedad Pandémica. Asimismo se considera probado que solamente la Cirugía puede controlar en mayor o menor medida los devastadores efectos de la misma sobre la salud humana. Esto explica en cierta medida que el intenso camino recorrido desde los primeros bypass yeyuno-cólicos o yeyuno-iliales de Payne hasta los modernos bypass gástricos o bilio-pancreáticos por Laparoscopia y Robótica, haya sido un constante devenir en la búsqueda de la “técnica ideal”, con los mejores resultados, los mínimos efectos secundarios, la

mejor calidad de vida, la menor morbi-mortalidad y el máximo beneficio y seguridad tanto para el paciente como para el cirujano comprometido y especializado en esta compleja y difícil tarea de tratar Obesos Mórbidos.

Los trastornos metabólicos del bypass yeyuno-ileal, dieron paso a los primeros modelos de bypass gástrico desarrollado por E. Mason² y la no desdeñable morbi-mortalidad de éstos, al nacimiento de un nuevo concepto filosófico en el tratamiento quirúrgico de la Obesidad: la restricción alimenticia. Si el adelgazamiento por malabsorción intestinal se vincula a complicaciones metabólicas poco controlables, el adelgazamiento por disminución radical de la ingesta calórica, podía ser una alternativa válida y de menor agresividad quirúrgica.

Con la aparición en el mercado de nuevos instrumentos quirúrgicos de autosutura mecánica a mediados de los años 70, se produjo un excepcional salto hacia delante de toda la cirugía y posibilitó a E. Mason el poder desarrollar en 1980 un modelo de intervención quirúrgica restrictiva pura, al que denominó "gastroplastia"³, y que se convirtió rápidamente en el procedimiento más difundido y utilizado en el mundo durante más de quince años.

La siguiente revolución tecnológica viene dada por la aparición y desarrollo sin precedentes de las técnicas de Laparoscopia, sobre todo a partir de 1990. Sin embargo hasta 1993 no se consiguió la primera operación por Laparoscopia, cuando G. Cadiere aplicó un nuevo modelo de gastroplastia y colocó una banda gástrica ajustable a la que se llamó "Lap Band"⁴. La banda gástrica laparoscópica era, 30 años después, el mayor revulsivo que la Historia de la Medicina podía situar frente al bypass intestinal de Payne y actualmente sigue siendo considerada como la técnica standard en múltiples Centros Quirúrgicos del mundo. Sin embargo sus pobres resultados a medio y largo plazo, así como la elevada tasa de complicaciones y reconversiones⁵, hizo que al igual que la gastroplastia de Mason, los cirujanos bariátricos siguieran investigando en nuevos modelos quirúrgicos de mayor eficacia, mejor calidad de vida y menor número de complicaciones tanto iniciales como a distancia, surgiendo así nuevas técnicas de bypass gástrico⁶ y bypass bilio pancreático⁷, cada una de ellas a su vez no exentas de riesgos y, sobre todo en los segundos, con nuevos muy graves problemas tanto peri-operatorios como a distancia⁸.

En 1994, A. Wittgrove y W. Clark publicaron sus primeros cinco pacientes a quienes practicaron un bypass gástrico por laparoscopia⁹, incorporando al bagaje quirúrgico por vez primera una técnica mixta, parcialmente restrictiva y parcialmente malabsortiva, con los beneficios y sin los inconvenientes de ambas filosofías de tratamiento quirúrgico y añadiendo el componente de la cirugía mínimamente invasiva.

El bypass gástrico laparoscópico en sus diferentes variaciones técnicas¹⁰, se ha convertido en el "patrón oro" de la cirugía de la Obesidad en Norteamérica y otros países del mundo por acercarse lo más posible a lo que podemos hoy considerar como la técnica "ideal" en el tratamiento quirúrgico de la O.M.: bajo riesgo, alta pérdida de peso, corto tiempo operatorio, mínima estancia hospitalaria, mínima pérdida hemática, escaso dolor postoperatorio, alta satisfacción para el paciente y mantenimiento de la desaparición de las co-morbilidades con una pérdida de peso suficiente tanto a medio como a largo plazo.

En nuestra propia experiencia, después de más de 15 años operando obesos mórbidos y haber experimentado diferentes tipos de tácticas y técnicas quirúrgicas, comprobando y siguiendo personalmente a cada paciente, aplicando con pasión la evolución de la tecnología puesta al servicio de la cirugía, habiendo sido pioneros en laparoscopia y robótica, con todo lo que eso puede acarrear en los costes añadidos de la "curva de aprendizaje" y sobre todo, entregados a tiempo completo en la actualidad al intento de recuperar al Obeso Mórbido para la vida y la sociedad, solo nos queda por añadir que el camino iniciado por el Dr. Payne, De Wind y cols. fue fundamental en la Historia de la Cirugía de la Obesidad, nos inició en el complejo mundo del desconocimiento del "status morbid" y nos ha obligado a continuar su propia labor con la humildad del que aprende con cada nuevo paciente que opera y del que sabe que aún nos queda todo por aprender.

Nota: En la sección de Clásicos en Nutrición se reproduce el artículo de Payne y De Wind al que hacemos referencia.

Referencias

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Metabolic Observations in Patients with Jejunocolic Shunts*

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Most surgeons have been confronted with many interesting, and, as yet, unanswered problems of the patient who has had a major portion of their small intestine resected in an uncontrolled situation. The usual reasons for the uncontrolled bowel resections are mesenteric artery occlusion with infarcted intestine, volvulus, extensive neoplastic disease, ileitis and adhesions. An enormous amount of clinical and laboratory experience has been accumulated that man can survive the sacrifice of most of his intestine [1-5].

In 1954, Kremen, Linner and Nelson [2] reported a careful study in dogs of the consequence of bypassing various portions of the small intestine. The significant conclusion of their study was that "sacrifice of the distal 50 per cent of the small intestine produces a profound interference with fat absorption associated with loss of weight." Doctor Philip Sandblom of Lund, Sweden, in discussion of the paper stated that "this questionable method of controlling obesity will have the necessary experimental foundation." He also mentioned that Dr. V. Henrikson of Gothenberg has resected "an ap-

propriate amount of small intestine" because of obesity and had induced weight loss, but created a situation of difficult nutritional balance.

In the course of continuing studies of the basic nature and treatment of the obese state, opportunity arose in 1956 to study the metabolic effects on patients who had a planned controlled intestinal bypass operation. The purpose of this paper is to present the clinical observations and laboratory findings in these patients.

METHODS AND MATERIALS

The clinical study included ten patients who had planned jejunocolic shunts bypassing some jejunum, the entire ileum and the right colon. Partial or complete intestinal continuity was re-established when the ideal weight was reached or before if a valid reason presented itself.

Patients selected for surgical therapy were considered to have uncontrolled obesity. In our opinion, uncontrolled obesity exists when the patient is at least 125 pounds overweight, all other methods to control weight have been tried and failed, and life was endangered by an associated disease such as cardiopulmonary failure (Pickwickian syndrome), diabetes, hypertension and liver disease. All of our patients willingly agreed and seemed to understand the serious nature of the undertaking. The indications for surgery were rigid and limited to a very few extremely obese patients. The study was divided into seven phases (Table I).

*Presented at the Annual Meeting of the Pacific Coast Surgical Association at Palm Springs, California, February 3-6, 1963.

†Deceased, December 8, 1961.

Table I*Seven phases in the evaluation and treatment of an obese patient***Phase One**

Clinical, psychologic screening and laboratory examinations includes: complete blood cell count and morphologic study, urine analyses, serum proteins, serum protein bound iodine, serum cholesterol, blood urea nitrogen, total protein, fasting blood sugar, electrocardiogram, twenty-four hour excretion of creatinine, 17 keto-steroids, and 17 ketogenic steroids excretion.

Phase Two

Preparation for surgery includes: glucose tolerance test on high carbohydrate diet (oral and intravenous), bromsulphalein excretion test, serum sodium, CO₂, potassium, calcium, phosphorus, alkaline phosphatase, and bowel preparation with Neomycin.

Phase Three

Initial surgery includes: jejunocolic shunt, panniculectomy, intestinal biopsy, liver biopsy and kidney biopsy. Umbilical hernioplasty and an appendectomy if indicated.

Phase Four

Postoperative follow-up study includes: careful clinical observation, laboratory studies as done in preoperative studies, and serum carotenoid levels.

Phase Five

Second preoperative study and preparation for surgery (Phases One and Two).

Phase Six

Surgical revision of shunt, including kidney, liver and jejunal biopsies with panniculectomy. Remove any pathologic organs.

Phase Seven

Postoperative follow-up study includes: careful clinical observation and serial laboratory studies as indicated.

CASE REPORTS

CASE I. L. M. was chubby during her childhood. At age sixteen, during a period of continuous hospitalization on a measured 1,000 calorie diet she lost weight from 240 pounds to 145 pounds. One year later she weighed 240 pounds. At age twenty-five, she was 5 feet 2 inches tall and weighed 294 pounds with a blood pressure of 250/160 mm Hg. At this time, metabolic studies were consistent with the clinical diagnosis of "Cushing's syndrome." In May 1954 an exploratory celiotomy, ovarian biopsy and left adrenalectomy were done. Pathologic report of the resected adrenal did not confirm the diagnosis. In 1956, her weight was 292 pounds and her blood pressure 260/150 mm Hg. She was in cardiopulmonary failure spending most of her time in bed either eating or sleeping. It was the internist's impression that she represented the classical Pickwickian syndrome. After prepara-

tion in May 1956, a controlled jejunocolic shunt was created. A small wound seroma was the only complication. She was discharged on her fifteenth postoperative day. Her only complaint was anal irritation from six to ten semisolid stools per day. Six months later, she still had five or six bowel movements a day when she over ate food of high fat or carbohydrate content. In excess, these foods produced intestinal cramps and prolonged diarrhea for thirty or forty minutes after each meal.

In May 1957, the intestinal shunt was abolished and normal intestinal continuity was established. A gallbladder filled with stones was removed; biopsy specimens were taken of the liver, kidney and intestine. She weighed 120 pounds with a blood pressure of 120/70. She was weak, but otherwise had no complaints. Photographs before and after the intestinal shunt are presented.

CASE II. B. E., a twenty-five year old 4 feet 11 inch Caucasian married woman, weighed 242 1/2 pounds. Since age twelve, she gained weight steadily in spite of a "very low intake." She tried various diets on numerous occasions. In addition, she consulted several "obesity specialists" including a psychiatrist, but without any improvement. She had menstruated infrequently and scantily during the past three years. There was no family history of excess weight. After careful evaluation (Table I), she was referred for surgical therapy. On April 23, 1957, a controlled jejunocolic shunt was created. She was discharged on her eleventh postoperative day. Only complaint was anal irritation from six stools per day.

Her recovery was satisfactory with a weight loss which averaged five pounds per month. By the fifth month, her menstrual periods became regular. She did report thinning of scalp hair. In August 1958, she weighed 134 pounds; then, the rate of weight loss slowed down. It was ten months later before she weighed 118 pounds with a blood pressure of 120/70 mm Hg.

On June 15, 1959, fifteen inches of jejunum was anastomosed to 20 inches of ileum. She was discharged eight days later weighing 112 pounds. Her calculated ideal weight was 111 pounds. Within two months, she became pregnant. With this pregnancy she gained to 170 pounds. Since that time, she has had three children, the latest on January 17, 1963, at which ti-

me she weighed 160 pounds and was eating everything she wanted.

CASE III. W. H., a twenty year old 5 feet 3½ inches Caucasian woman, weighed 307 pounds, para 11 gravida 11. History of being fat since age six in spite of "I have tried everything to lose weight, but can't." After careful evaluation, (Table I) a controlled jejunocolic shunt was created on June 25, 1957. In addition, a liver biopsy, appendectomy, umbilical hernioplasty and panniculectomy were done. (Tables II and III.) Except for an initial fall in blood pressure, the patient tolerated the procedure well and made an uneventful recovery. She was discharged on her ninth postoperative day. She was seen at regular intervals for observation, the last time was December 12, 1957. She was in excellent condition, in electrolyte balance and weighed 204 pounds. On December 23, 1957, she died suddenly of a pulmonary embolism. The origin of the embolus was from the pelvic veins, established at postmortem examination.

CASE IV. C. L., a forty-two year old, 5 feet 8 inches Caucasian woman, weighed 318 pounds with a blood pressure of 154/110 mm. Hg; her father is a Doctor of Medicine. She has been fat since early childhood and all measures to reduce her weight were either temporary or failed. After the usual preoperative evaluation (Table I), she

was referred for surgical therapy. In June 1957 a controlled jejunocolic shunt was created. An appendectomy, umbilical hernioplasty, panniculectomy and liver biopsy were also accomplished. (Tables II and III.) Her postoperative course was complicated by thrombophlebitis and she was discharged on the twentieth postoperative day. She was seen at regular intervals and was losing weight on an average of three pounds per week. However, this patient became unreliable and failed to keep her appointments, was drinking heavily which we learned now as not being new for her, became hostile and had a myriad of complaints. Consequently, we were unwilling to continue with the intestinal shunt. Therefore, on March 25, 1958 intestinal continuity was completely re-established before the ideal weight was reached. Her weight was 193 pounds; she had lost 126 pounds in thirty-nine weeks. Her blood pressure was 130/70 mm. Hg. She was discharged on her tenth postoperative day with no complaints. She was last seen in May 1958 when she weighed 201 pounds. We have not seen or heard from her since that time.

CASE v. R. G., a 5 foot 8 inch thirty year old Caucasian woman, weighed 247 pounds. She gave the usual history of these obese women. Her blood pressure was 114/100 mm Hg. After the usual preoperative evaluation (Table I), she was referred for surgical therapy. On July 2, 1957, a controlled jejunocolic shunt was created. In addition, an appendectomy, umbilical hernioplasty, panniculectomy and liver biopsy were done. (Tables II and III) She was discharged on the tenth postoperative day after an uncomplicated recovery. She had eight to ten stools per day with anal irritation. Except for modest loss of hair and a complaint of weakness, her convalescence was satisfactory. On February 28, 1958, normal intestinal continuity was re-established in addition to panniculectomy, renal and liver biopsy. Her weight reached a low of 144 pounds and her blood pressure was 110/60 mm Hg when she was discharged on her seventeenth postoperative day. In spite of "really trying" she regained her weight to 250 pounds. Last seen on January 28, 1963, at age thirty-six, her weight was 244 pounds. She came in asking to have the operation done again, "Please give me just one more chance."

Table II
Initial surgical procedures

<i>Data</i>	<i>No.</i>
Jejunocolic shunt	10
Panniculectomy	10
Liver biopsy	10
Intestinal biopsy	10
Renal biopsy	3

Table III
Additional surgical procedures

<i>Procedure</i>	<i>No.</i>
Appendectomy	5
Umbilical hernioplasty	3
Cholecystectomy	1
Hysterectomy	1

CASE VI. E. L., a 5 foot 2 inch forty year old Caucasian woman, weighed 255 pounds. She gave the usual history as recorded previously. Her blood pressure was 140/90 mm. Hg. After the usual preoperative evaluation, she was referred for surgical therapy. On July 9, 1957, a controlled jejuno-colic shunt was created. In addition, an appendectomy, panniculectomy and liver biopsy were done. (Tables II and III.) She was discharged on her eighth postoperative day after an uncomplicated convalescence. It was necessary to rehospitalize her on April 22, 1959, because of symptoms which suggested potassium and calcium depletion, in spite of normal serum levels (calcium, 4.3 mEq. per L.; potassium, 4.8 mEq. perL.). It was apparent that we were unable to control her electrolyte balance by oral medicine. Consequently, on April 30, 1959 intestinal continuity was partially reestablished. Eighteen inches of jejunum was anastomosed to 42 inches of distal ileum. Biopsy specimens of the liver and intestine were taken. She was discharged on her ninth postoperative day after an uncomplicated recovery, weighing 130 pounds and a blood pressure of 110/70 mm Hg. She was seen during the postoperative period on ten occasions. When last seen on November 1, 1961, we were back where we started at 254, pounds with a very unhappy, unstable woman.

CASE VII. D. L., a twenty-six year old 5 foot 1 inch Caucasian woman, weighed 242 pounds. Blood pressure 164/110 mm. Hg. Until seven years ago, she was of average weight, 120 pounds. Since her marriage, there was a gradual increase in her weight. After this, her historical review is identical to the other obese women. After the usual work-up (Table I), she was referred for surgi-

cal therapy. On July 19, 1957 a controlled jejuno-colic shunt was created. In addition, a panniculectomy and liver biopsy were done. After an uncomplicated postoperative course, she was discharged on her eighth postoperative day. She had only one stool after each meal. After six months, she was having trouble with profuse menstruation for protracted periods of time up to seven weeks. On June 20, 1958, at the weight of 134 pounds and blood pressure of 126/82 mm Hg, her intestinal continuity was re-established to normal. In addition, a total hysterectomy, panniculectomy, liver and renal biopsies were done. She was discharged after an uncomplicated recovery, weighing 128 pounds on her eleventh postoperative day. Since discharge, she was seen at regular intervals. Her weight was last recorded at 124 pounds in 1961.

CASE VIII. I. L., a thirty-two year old 5 foot 2 inch Caucasian woman, weighed 391 pounds with a blood pressure of 180/90 mm Hg. She is a teacher of abnormal psychology. Since childhood, she has been fat. Her mother is heavy, but her father is not. Other than this, she gave the usual history of the obese woman. After evaluation (Table 1), she was referred for surgical therapy. On July 19, 1959, using two operating tables to support the patient, a controlled jejuno-colic shunt was created. In addition, a panniculectomy and liver biopsy were done. She had an uneventful recovery and was discharged on her eighth postoperative day. This patient had a great deal of difficulty maintaining her serum protein, calcium and potassium levels. She had to be admitted to the hospital on three occasions for intravenous therapy because of inability to control her serum electrolytes by oral medication. (Tables V and VI.) Therefore, on January 14, 1958, normal gastrointestinal continuity was re-established. On her tenth postoperative day she was discharged feeling well and weighing 280 pounds, with a blood pressure of 104/70 mm. Hg. It was necessary to do bilateral thigh lipectomies (twenty five pounds each) in October 1961 to enable her to walk. At this time, she was still teaching abnormal psychology daily and would like to have the operation again.

CASE IX. D. F., a 5 foot 2 inch twenty-five year old Caucasian woman, weighed 247 pounds with a

Table IV		
<i>Other investigators interested in the intestinal bypass operation</i>		
<i>Doctor</i>	<i>Cases</i>	<i>Institution</i>
A. K. Kremen	8	University of Minnesota
C.d. Sherman, Jr	4	University of Rochester Medical Center, Rochester, New York
J. C. Drye	3	University of Luouville
N. C. tanner	2	Charing Cross Hospital, London, England
R. B. Turnbull, Jr.	2	Cleveland Clinic

Table V
Highest serum potassium level on preshunt period;
lowest level in shunt period

Case No. and Patient	Preshunt Period	Shunt Period	Symptomatic
I, L. M.	4.8	3.7	...
II, B. E.	4.7	3.9	...
III, W. H.	4.3	...	...
IV, C. L.	4.4	3.3	X
V, R. G.	4.4	3.5	...
VI, E. L.	5.1	3.8	X
VII, D. L.	4.3	3.4	...
VIII, I. L.	3.9	2.7	XX
IX, D. F.	4.5	3.8	X
X, L. B.	4.8	4.0	X

Note: Normal = 4.1 to 5.6 mEq. per L.

Table VI
Highest serum calcium level in preshunt period;
lowest level in shunt period

Case No. and Patient	Preshunt Period	Shunt Period	Symptomatic
I, L. M.	...	...	...
II, B. E.	...	5.0	...
III, W. H.	...	...	...
IV, C. L.	5.3	5.2	...
V, R. G.	5.1	4.7	...
VI, E. L.	4.3	3.8	X
VII, D. L.	5.2	5.0	...
VIII, I. L.	7.0	2.6	XX
IX, D. F.	4.9	4.7	X
X, L. B.	4.4	4.1	X

Note: Normal = 4.5 to 5.5 mEq. per L.

blood pressure of 160/90 mm. Hg gave a history similar to the other patients in this series. After the usual work-up (Table I), she was referred for surgical therapy. On July 23, 1957, a controlled jejuno colic shunt was created. In addition, an appendectomy, panniculectomy and liver biopsy were done. She made an uncomplicated recovery and was discharged on the seventh postoperative day. Her only complaint was constipation. During the following seven months, she was admitted to the hospital because of pain in the left lower quadrant of her abdomen, dehydration and a low serum potassium (3.8 m Eq. per L.). On March 27, 1958 when she weighed 134 pounds with a blood pressure of 110/70

mm. Hg, normal intestinal continuity was re-established. In addition, biopsy specimens were taken from the liver and intestinal tract. After an uncomplicated convalescence, she was discharged on her seventh postoperative day. With increasing domestic problems, she promptly regained her weight to 255 pounds by April 1961.

CASE X. L. B., a 5 foot 2 inch thirty-one year old Caucasian woman, weighed 268 pounds. Her blood pressure was 250/150 mm. Hg. She gave the same history as the other obese patients in this group. After thorough evaluation, she was referred for surgical therapy. On November 4, 1961, a planned jejunocolic shunt was done. Twenty inches of jejunum was anastomosed to the transverse colon. In addition, the liver and intestine were biopsied. Her recovery was uneventful and she was discharged on her seventh postoperative day. She had five stools per day. It soon became apparent that she had an incisional hernia. After losing 147 pounds, she was admitted for revision at the weight of 119 pounds and her blood pressure was 118/70 mm. Hg. On December 10, 1962, 15 inches of jejunum was anastomosed to the side of the ileum 10 inches from the ileocecal valve. Biopsies were taken of the liver and intestine. Her postoperative course was uneventful. At the time of discharge on her tenth postoperative day, she weighed 118 pounds and her blood pressure was 120/70 mm. Hg. Except for a mild weakness, she was in good condition. The patient was last seen on February 1, 1963. her weight was 123 pounds and she is clinically well.

SURGICAL PROCEDURE

The operation was done exactly the same in the first nine patients. The tenth operation varied in one respect. The jejunum was divided 20 inches from the ligament of Treitz instead of 15 inches. A transverse elliptical incision was used excising the fatty abdominal apron and the umbilicus. The average depth of the subcutaneous fat was 6.4 cm. (the largest 11 cm. and the smallest 3 cm.); the average weight of the panniculus was 1,971 gm. (the largest 2,388 gm. and the lightest 230 gm.). Both rectus abdominis muscles were divided transversely and the celomic cavity entered. An exploratory celiotomy was performed. Biopsy specimens were taken

from the liver, kidney and jejunum. (Table II.) If the appendix was present, it was removed. Any pathologic organ was excised. If an umbilical hernia was present, it was repaired. (Table III.)

The jejunum was divided 15 inches from the ligament of Treitz. Measurement was made on the mesenteric border. The distal end was closed in two layers, using 4-o catgut for the inner row and 4-o silk in the outer layer. The end of the proximal jejunum was anastomosed to the side of the transverse colon, to the right of the midline. A two layer anastomosis was done using 4-o catgut for the inner layer and interrupted 4-o silk for the outer row. The abdominal wound was closed with chromic o catgut in the peritoneum and transversalis fascia; interrupted No. 24 cotton in the fascia; No. 26 steel wire retention sutures were used down to, but not through, the peritoneum; and interrupted 3-o silk in the skin. Penrose drains were brought out at each end of the long transverse incision. Spinal anesthesia was used, in all but one patient who had a general anesthetic. No significant anesthetic problems were encountered.

REVISION

The first six patients requiring revision had their intestinal tract restored to normal continuity. The other three have had less than normal length left in continuity. E. L. (Case VI), had 15 inches of jejunum anastomosed to the ileum 42 inches from the ileocecal valve. B. E. (Case II), had 15 inches of jejunum anastomosed to the ileum 20 inches from the ileocecal valve. L. B. (Case X), had 15 inches of jejunum anastomosed to the ileum, 10 inches from the ileocecal valve.

We have not resected any small bowel except for biopsy purposes. The gut has been merely bypassed. To date we have not had any symptoms or pathologic changes to suggest the "blind loop" syndrome. Mr. Tanner [6] states he prefers and did, indeed, resect the intestine in the two cases he reported to us. (Table IV.)

RESULTS

Blood Pressure. Eight of the ten patients had elevated blood pressure recorded when they were

obese. In each instance the blood pressure returned to normal when significant weight loss had occurred. Cases I and x were considered to be examples of the classic Pickwickian syndrome. Both patients were in cardiopulmonary failure with blood pressure recordings of 240/160 and 240/150 mm. Hg, respectively. They responded in a gratifying manner. Their symptoms of cardiopulmonary failure were relieved after they had lost approximately fifty pounds. Patient (Case I) remained symptom free until she regained most of her weight. Patient (Case x) has remained clinically well.

Electrolytes. No consistent or unphysiologic changes were observed in the serum levels of sodium, carbon dioxide combining power, phosphorus, alkaline phosphatase, urea nitrogen, creatinine or iron.

Potassium. In spite of large supplemental oral intake, the serum potassium levels fell in all ten patients. (Table V.) Five patients were symptomatic and required intravenous therapy at various times to restore their well being.

Calcium. Because calcium is primarily absorbed in the upper gastrointestinal tract, we did not expect to see hypocalcemia. It soon became apparent with the decreased transit time and diarrhea that not enough calcium was being absorbed. (Table VI) All patients, after the third, were given supplemental calcium. Four patients had symptoms suggesting calcium deficiencies. Two had to be hospitalized to receive intravenous potassium and calcium to restore their well-being. A deficiency in Vitamin D absorption may be a factor in the low serum calcium levels. Numerous roentgenograms were taken of these patients; no evidence of demineralization of the bones was noted. Because the serum levels of potassium and calcium could not be maintained except in the hospital, two patients (Cases IV and VIII) had their intestinal continuity re-established before the calculated ideal weight had been obtained.

Cholesterol. During the shunt period the serum cholesterol levels fell into the normal range. Similar results were recorded by Lewis, Turnbull and Page [7]. Measurements in three of our pa-

tients in the postshunt period, after significant weight gain had occurred, revealed they all had raised to higher levels. The changes subsequently to be described in the liver may also be a factor by affecting the endogenous synthesis of cholesterol by the liver.

Carotenoids. Serum carotene levels were measured only during the shunt period. Each measurement was below the normal range. Our observations are in accord with others who have found that the serum carotene levels are extremely valuable in the diagnosis of the malabsorption syndrome.

Adrenal Steroids. It was possible in four patients to study urinary excretion of 17 ketosteroids and 17 ketogenic steroids prior to and during the shunt period. Three patients had a significant reduction in the 17 ketosteroid and 17 ketogenic steroid levels during the period of intestinal bypass. One only had a minor rise in excretion levels of both substances.

Blood Studies. Many blood counts and stained smears were done in all ten patients. All had a slight fall in number of erythrocytes. Also, the hemoglobin content gradually fell. This was especially true in the "Pickwickian" (Case I) in which the hemoglobin content fell from 17.4 gm. to 14.2 gm. The leukocyte counts and distribution of cells remained within the normal range. In only one instance, Case IX, was there a report of slight anisocytosis and poikilocytosis during the shunt period. Serum iron levels were measured in only one patient (Case x), and they were in the low normal range during the shunt period. Therefore, she was treated with intramuscular injections of iron.

Protein. In all ten patients there was a fall in the levels of serum protein bound iodine. This can be correlated with the low serum protein levels also seen in our patients and may represent a drop in the thyroid binding globulin. Predigested proteins (hydrolysates) were poorly handled. Their ingestion produced an increase in distressing diarrhea. A high carbohydrate diet containing a modest amount of protein and fat will provide the lowest fecal nitrogen and fat excretion [5]. Although we attempted to regulate their diets in this

manner, these patients were not able or willing to follow our instructions.

In all but two instances (Cases II and V), serum protein paper electrophoresis measurements were recorded at the end of the shunt period. There was a modest reduction in the total proteins. The albumin content was slightly lower than normal in two patients. The greatest changes were seen in the globulin fraction. Alpha₁ was elevated in three patients; alpha₂ low in two patients; alpha₃ was present in two patients; and beta was normal in all. The gamma fraction was slightly elevated in three patients.

Carbohydrate. The carbohydrate metabolism appeared to be altered during the shunt period as evidenced by the flat glucose tolerance curves observed in this series. Another indication of disturbed carbohydrate metabolism in our series was that several patients complained of distention and excessive flatulence.

Fat and Body Weight. The most significant finding in these patients was their failure to absorb fat. The amount of fat absorbed varied with the individual person and amount of fat eaten, amount of intestine in contact with the ingested fat, and transit time. It was certain that if they ate a large, fatty meal, they would pay for it in diarrhea and anal irritation. The subsequent diarrhea made the electrolyte control more difficult. Fat requires digestion before it can be absorbed. Although some is absorbed in the jejunum, absorption is not normally complete until it passes through the ileum. Failure to absorb fat produced a relentless weight loss. The average weight loss at fifty-two weeks was 123 pounds. Although variable with occasional plateaus, the patients lost weight on an average of 2.36 pounds per week. An interesting comparison is the 2.5 pounds per day weight loss recently reported during periods of total fasting [8]. With both 15 inches and 20 inches of jejunum in use, weight loss was noted until gastrointestinal continuity was either partially or completely restored. One patient (Case II) went 112 weeks before revision. Her weight stabilized between 125 and 130 pounds for almost one year. Then her weight suddenly dropped to 118 pounds. At that time, intestinal continuity was partially restored.

Renal. Needle biopsies of the kidney in three cases did not reveal any pathologic process.

Intestine. Biopsies of the jejunum were done at the time of the initial surgery in all ten patients. No gross or microscopic abnormalities were seen. When the intestinal shunts were revised, a biopsy was taken from the proximal and the bypassed jejunum. Again no gross or microscopic pathologic condition was identified. We did not observe any objective or symptomatic evidence of the blind loop syndrome.

Liver. Liver function was estimated by bromsulphalein (BSP) retention tests. (Table VII.) Five of the seven patients studied prior to the intestinal shunt had abnormal BSP retention. The remaining two had borderline elevations. At the end of the shunt period, four of the seven had abnormal BSP tests, one was normal and two had borderline elevation. In five patients in whom comparison was possible between the pre- and postshunt periods, the BSP was unchanged or slightly elevated in three and significantly elevated in two. The latter two had significant morphologic change in the liver during the shunt period. In the other three, there was no positive correlation between the BSP and the fatty changes in the liver. All patients in our series had liver biopsies done at the time of

the initial surgery. In four, the fatty change was absent or slight. The other six showed a moderate degree of fatty change. When slight, the fatty change was irregularly focal in distribution. When moderate, fatty deposits were centrolobular. In three patients, slight periportal fibrosis was noted; and in several, periportal inflammatory change was present. No alcoholic hyalin, necrosis, fatty "cysts," nodular hyperplasia or frank cirrhosis were present. Nine patients had liver biopsies at the time of revision. All showed a varying degree of fatty change, either moderate or severe. There was only one patient in whom the fatty change remained the same or diminished at the end of the shunt period. Significantly, there was no increase in fibrosis or other pathologic changes noted after the shunt period.

Two cases (v and vii) were of particular interest in that the appearance of the liver changed from normal or only slightly fatty change to one of rather severe change. Where the fatty change was pronounced and associated with slight periportal fibrosis, the histologic picture was similar to that of an early stage of Laennec's or nutritional cirrhosis. There was no evidence of reversibility of the fatty change in the period of study despite the striking weight loss.

COMPLICATIONS

Surgical complications were minimal. (Table VIII.) In fact, we were delightfully surprised to see how well these enormous persons tolerated major surgical procedures. There has been no surgical mortality. All patients had diarrhea with anal discomfort of variable degrees. Most started out with ten to twelve stools per day. By the time they left the hospital, this had been reduced to three to five stools per day. After discharge, the

Table VII
Liver changes*

Patient	Preshunt		Shunt Period		No. of weeks
	Liver biopsy	Bromsulphalein Per cent†	Liver biopsy	Bromsulphalein Per cent†	
I	+++	...	+++	...	51
II	o+	...	++	o	112
III	+++	23	++++	...	26
IV	+++	7.5	+++	6	39
V	o+	5	+++	5	34
VI	++	10	++	5.5	91
VII	o+	5	+++	30	48
VIII	o+	11.5	...	...	26
IX	o	16	++++	29	44
X	+++	...	++++	9	57

*Results of the bromsulphalein retention tests, and an estimation of the degree of fatty changes seen in the liver biopsies.

†Normal 4 per cent or less.

Table VIII
Complications

Data	No.
Incisional hernia	1
Wound seroma	1
Electrolyte problems	5
Scalp hair loss	2
Thrombophlebitis	1

number of stools per day was governed by the nature of food and liquid intake. If they went on a carbohydrate or fat binge, they paid for it by spending most of the day on the toilet with distressing rectal symptoms, such as pain and bleeding. One patient had an incisional hernia, one a wound seroma, two reported thinning scalp hair, one had a thrombophlebitis and five had difficulty maintaining their serum potassium and calcium levels in spite of oral supplementation.

COMMENTS

The clinical and laboratory details of ten morbidly obese female patients who had planned, controlled jejuno-colic shunts have been presented. The physiologic and emotional aspects of obesity as related to mental health have been partially studied in man; the published report has clarified several facets of this intriguing problem [9]. The scope of this paper does not permit a comprehensive review of the reasons why these patients were obese, and with one exception unable to maintain their ideal weight. Suffice to say that they were not able to remain thin and regained their original weight, almost to the pound. The later observation may be significant. The theory that slimness resolves all problems of the obese patient is seriously challenged by our results. One patient (Case II) had her regular menstrual cycle restored. After this she has been able to have three pregnancies and three children.

The blood pressure was lowered during the shunt period in every instance, dramatically so in two. It is our impression that the lowered levels of blood pressure were salutary and not the result of adrenal insufficiency, dehydration or electrolyte imbalance.

No consistent or pathologic changes were observed in the serum electrolyte levels except potassium and calcium. Oral supplementation with potassium and calcium were required. It was necessary to re-establish intestinal continuity in two patients before the ideal calculated weight had been obtained because adequate serum levels of potassium and calcium could not be maintained except in the hospital.

Initial high levels of the serum cholesterol fell to normal during the shunt period. These obser-

vations indicate that when a smaller absorptive area is present, smaller amounts of cholesterol and cholesterol precursors are absorbed. The extremely low serum corotene levels we recorded during the shunt period may reflect an inadequate transport vehicle as suggested by Cornwell, Kruger and Robinson [10] and Lewis, Turnbull and Page [7].

The change in urinary excretion of 17 ketosteroids and 17 ketogenic steroids during the shunt period are interesting. The significant reduction in three patients during the shunt period is consistent with the hypothesis that obesity represents physiologic stress. Better support for this concept could be provided by demonstrations of consistently lowered levels at stabilized weights. Increased excretion of adrenal steroids in obesity makes it difficult to exclude Cushing's syndrome in some subjects [11]. An additional source of difficulty is the presence of facial hair and abdominal striae.

The drop below normal in Case IX should probably not be considered significant without confirmation, but it alerts us to the possibility of adrenal failure, particularly in the presence of disturbed electrolyte balance. The flat glucose tolerance curves most likely are a reflection of a shortened time of exposure to the absorptive surface of the duodenum and jejunum. Studies in animals and man show that glucose is absorbed in the upper part of the intestinal tract and should be complete before the ileum is reached. There is excellent evidence that the frequency of diabetes in the obese adult is three to four times as great as in the nonobese adult [12]. Similar observations in the controlled and uncontrolled intestinal shunt have been reported by other investigators [4,5].

Failure to absorb fat produced a variable but relentless weight loss. However two patients had to have normal intestinal continuity restored before calculated ideal weights were achieved because of serious metabolic disturbances created by the intestinal shunt. It is significant that only one of the seven patients who had complete intestinal continuity restored was able to maintain an ideal weight. It is extremely interesting to note that the patient (Case VI) was able to regain her original weight of 255 pounds with only 15 inches of jejunum and 42 inches of ileum. Also, the patient (Case II) was able to gain to 160 pounds with only 15 inches of jeju-

num and 20 inches of ileum. Patient (Case X) has 15 inches of jejunum and 10 inches of ileum. Her weight is now 118 pounds on a generous American diet. However, the period of observation has been too short for this to be a valid observation. At the present time, she is clinically well.

The changes that we observed in the peripheral blood picture were minor and were not consistent with the report of Booth [1] that in these patients a megaloblastic anemia from Vitamin B₁₂ deficiency should develop. However, it is entirely possible that our patients did not have their intestinal shunts long enough to exhaust the body stores of Vitamin B₁₂. It must be remembered that most of our patients had some degree of abnormal liver function. Patient (Case x) only received parenteral Vitamin B₁₂. Evidence has been recorded indicating that if any patient has been permanently deprived of the ileum, he will require Vitamin B₁₂ treatment indefinitely [1]. Our observations were consistent with the fact that no signs or symptoms to suggest a blind loop syndrome were seen in any of our patients.

Protein requires digestion before it can be absorbed. Consequently, much of the protein ingested is absorbed by the ileum. Therefore, with the ileum bypassed, relatively small amounts of protein will be absorbed. In spite of excessive loss of nitrogen in the feces, these patients can be kept in positive nitrogen balance if given a high protein diet. Clinical evidence to substantiate this has been reported by Christensen, Musgrove and Wallaeger [13].

Renal biopsies did not produce any significant changes.

No significant gross or microscopic changes were seen in the jejunum in continuity or in the bypassed segment.

The occurrence of fatty change in the liver in the obese patient is well known. The pathogenesis of these changes has not been established.

Bromsulphalein retention tests were useful as a measure of hepatic function in this group of patients, but did not consistently correlate with the severity of fatty changes as found in the biopsy. Fatty changes were present in most of the obese patients in our series and varied from mild to moderate. The shunt procedure, although causing weight loss, did not reverse the fatty changes in the liver. There was some evidence that the pathologic changes were increased. Two cases are of par-

ticular interest in this regard, since although obese, they had little or no fatty liver changes prior to the shunting procedure. Paradoxically, although the shunt led to dramatic weight loss in these two patients (as in the others), liver changes of considerable severity appeared in both. In addition to fatty changes, slight fibrosis and periportal inflammatory changes were present in several of the patients. The changes described were not appreciably altered by the shunt procedure. True Laennec's cirrhosis did not appear in any of our patients during the period of observation.

Whether these changes in the patients with intestinal shunts will subside or prove more serious must await further follow-up observations over a longer period of time.

Complications were minimal. The most important complication was the disturbance in the potassium and calcium balance. Diarrhea and anal irritation was a distressing situation. The serious metabolic disturbances, which are created, are not completely understood.

The minimum amount of small intestine required to support life has not been established, but our studies indicate it will be very little. Survival plus clinical well-being has been reported in a patient with only 18 inches of small bowel remaining [3]. A very complete study on the normal functions of different segments of the small bowel and the metabolic effects of intestinal resection has been published by Booth [1].

There are other investigators and clinicians who are interested in these unfortunate, obese patients. Controlled intestinal bypass procedures have been done in their institutions for control of obesity. The number of cases each man has had is shown on Table IV. In addition, we are grateful to them for the moral support and encouragement given us to publish this report [2,4,6,7,15].

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DISCUSSION

LEON GOLDMAN (San Francisco, Calif.): This report of ten patients in whom small bowel shun-

ting procedures were performed to treat obesity is the largest series thus far recorded. The authors are to be congratulated for taking advantage of the opportunity to do an excellent metabolic study as a by-product of the surgical procedure. The authors have now abandoned this operation because six of the seven patients whose shunts were reconstituted to normal reverted to their former weight. We know that resection of the small intestine with the preservation of 15 to 20 inches of proximal jejunum, which is occasionally necessary to extirpate the gangrenous bowel caused by thrombosis of the superior mesenteric artery, is almost always incompatible with maintenance of life.

As the authors pointed out, the absorptive and metabolic effects of resection of the same length of small bowel vary widely from patient to patient. When considered *in toto*, the small bowel, unlike the stomach or colon, is a vital organ.

Defunctionalization of most of the jejunum and all of the ileum in the patients just reported was usually followed by malabsorption and metabolic changes due to rapid transit time, failure of proper enzymatic digestion, and malabsorption of certain food substances, vitamins and minerals. Their studies corroborate in human beings the findings of Kremen, Linner and Nelson, Clatworthy, Saleeby and Lovingood in dogs. The authors carefully studied the effects of malabsorption and made valuable observations which may be applicable in the care of patients after surgical procedures in whom all or part of the stomach or small bowel is removed or in the care of patients with intrinsic disease processes which may alter digestion and absorption. The marked steatorrhea, loss of body fat and protein have been well recognized. They found that carbohydrate absorption tends to produce a flattened glucose tolerance curve after the shunting procedure, which is a noteworthy contribution. Deficiency of calcium, often previously overlooked, was recognized by the authors in four patients and should be kept in mind in all patients with malabsorption. The formation of insoluble calcium soaps and the lack of absorption of fat soluble Vitamin D interfere with absorption of calcium. We have found that the anemia that develops is somewhat complex in that there may be an alteration in the intrinsic gastric factor, failure of Vitamin B₁₂ absorption and failure of folic acid and iron absorption.

Every surgeon should become familiar with the authors' description of the metabolic changes which occur after side-tracking or extirpation of large segments of small intestine. Certainly fat and protein loss, anemia, rapid transit or lack of digestion of food substances should be kept in mind. The relief of hypertension and cardiopulmonary symptoms in these patients again accentuates the possibility of improvement following weight loss in the obese patient. Loss of potassium and other electrolytes in the cases just reported is noteworthy. The authors agree that the use of this procedure to treat obesity has not been successful in their patients whose intestine was reconstituted.

JACK M. FARRIS (Los Angeles, Calif.): I simply want to congratulate Dr. Payne on the honest and forthright manner in which this most interesting subject was presented. I think he has made it clear that he is not advocating this operation as a definitive cure for obesity and that in certain instances it is incompatible with life.

I think, in all fairness, one should say that perhaps this operation does have a limited lifesaving application to certain persons who might be dying from the effects of obesity.

CARL P. SCHLICKE (Spokane, Wash.): A couple of years ago Hammer and his associates in Michigan found that after resection of 90 per cent of the small bowel in a dog, they were able to markedly slow down transit time and greatly reduce problems of metabolic imbalance by interposing a short segment of antiperistaltic bowel in that which remained.

Just recently David Hinshaw and his associates have reported the successful application of this principle to an elderly woman who had had 90 per cent resection for superior mesenteric thrombosis or occlusion; the patient survived and was having only one stool a day and doing very well a year later, although she lost a lot of weight.

I would like to ask Dr. Payne if he considered the interposition of an antiperistaltic loop in any of the persons, and whether or not this might have helped solve the profound metabolic disturbances which he encountered.

HERBERT WILLY MEYER (Rancho Santa Fe, Calif.): When I was privileged, as the guest of your

Association, to receive a program I was fascinated by the title of Dr. Payne's paper, and I knew that it would be presented in the beautiful manner in which he delivered it.

I thought that it might be of interest to briefly mention the result of a patient on whom I operated during World War II while we were in Luxembourg. A nineteen year old soldier had a shelf fragment wound of the thigh. The night before he was to be discharged, on the third day, severe abdominal pain developed and, in short, a thrombosis of the superior mesenteric artery just distal to the origin of the midcolic artery developed.

When I operated upon him, he had necrosis of all of the small intestine except the upper 18 inches of the jejunum. The caecum, ascending colon, and beginning of the transverse colon were necrotic. I had to resect all of the necrotic intestine and perform a jejuno-transverse colostomy just as Dr. Payne has described.

The interesting thing is that this boy is now living comfortably and well, over sixteen years since the operation. He lives in Iowa, and fortunately was willing to go to the Veterans Hospital in Iowa City where the doctors were kind enough, in the short time that he was there, to study him carefully.

He initially lost 35 pounds in weight, then slowly regained some of his weight, and is now steadily sixteen years later, 14 pounds below the weight he had at the time he was wounded. He has two or three bowel movements a day, and his main problem is absorption of fat. All other chemical and laboratory tests were within normal limits. These findings were reported in *Surgery* in June 1962.

It is interesting that the 18 inches of small intestine has tremendously dilated as well as the descending colon.

LOREN T. DEWIND (Los Angeles, Calif.): I would like to say that we are grateful for the comments that have been made here. Dr. Goldman's comments have certainly been helpful and apropos.

Potassium depletion has been a difficult thing to measure, because potassium, as you know, resides in the cells primarily, and the values of serum potassium are notoriously inaccurate in giving us a real picture of potassium stores.

In relation to the problem of hypocalcemia, I would like to say that we are in no position to evaluate the long-range effects of this procedure, or a modified procedure, on the bone stores of calcium, because it takes along time for the body to be depleted of calcium when one considers the enormous amount present in bone. For that reason the roentgenographic studies that we have on these patients are of limited value over this short period of time. We would feel much more secure if we had observations over a period of two or three years' time.

We have many more observations in mind should the opportunity arise to study this type of procedure again, or a modification.

In the matter of fatty livers, I do not think that any of us feel secure in evaluating the observations that have been presented to date. Apparently, it takes a long time for cirrhosis of the liver to develop. We do not know, for instance, whether or not in patients who are extremely obese in the mobilization of the fat *the liver may play an important role*, and what we see may be just a transient phase of fat mobilization which, once the weights became stabilized and a period of time went by, would result in a return to normal histology of the liver.

Finally, I would like to say that one of the matters that has not been resolved as yet, and is perhaps the biggest problem in relation to the treatment of obesity, is the development of psychologic problems. It is easy for an obese patient to say, "If I lose weight all of my problems will be solved." However, we know from this and from other observations that when we provide an opportunity for obese patients to lose weight, some of them will generate more psychologic problems than they had before they lost weight.

J. HOWARD PAYNE (closing): I wish to thank Dr. Goldman for his kind and wise discussion of our manuscript. Also, my thanks to Dr. Farris, Dr. Schlicke, Dr. Meyer and Dr. DeWind for their discussions.

We have not tried the antiperistaltic segment to slow down intestinal motility. We did not wish to alter this group of patients with any other variables.

As far as I know, none of the patients had any evidence of hypoglycemia. In regard to the problem of Laennec's cirrhosis, the Metropolitan Life Insurance Company figures state that in the obese male the incidence of Laennec's cirrhosis is 250 per cent that of the expected, and in the obese female it is as high as 150 per cent of the expected rate. Whether or not this shunt procedure produces cirrhosis, we cannot at this time say for certain. Our pathologist, Dr. L. J. Tragerman, who was so kind to spend considerable time with me studying the slides and patients, is of the opinion that Laennec's cirrhosis is not the end result in the liver as we saw it.

The shunt levels were selected because one of our patients had 15 inches of jejunum anastomosed to 42 inches of terminal ileum; she promptly gained back her original weight of 255 pounds in less than a year's time. The next patient, with a shorter segment, had 15 inches of jejunum anastomosed to 20 inches of ileum. The girl promptly gained weight back to 170 pounds. Patient (Case x) in our series is the one with less than her entire continuity re-established who has been able to maintain her ideal weight, but as I say, the period of observation has been too short to justify any valid conclusions.

In conclusion, I would like to thank the entire group for allowing me to present these observations on a somewhat controversial subject.