UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

DIVISIÓN DE ESTUDIOS DE POSTGRADO E INVESTIGACIÓN

FACULTAD DE MEDICINA

THE AMERICAN BRITISH COWDRAY MEDICAL CENTER, I.A.P.

CÁTEDRA DE CIRUGÍA "CARLOS PERALTA"

"El papel de la tomografia de abdomen para el diagnóstico de apendicitis aguda en el Centro Médico ABC"

TESIS DE POSTGRADO

QUE PARA OBTENER EL TÍTULO DE ESPECIALISTA EN:

CIRUGÍA GENERAL

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MÉXICO, D. F. **2013**

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Resumen

Introducción: La apendicitis aguda continua siendo hasta la actualidad un reto diagnóstico, si bien la clínica es la principal guía para el diagnóstico de la apendicitis aguda, la clínica no siempre es clásica y los avances en la tecnología nos han permitido apoyarnos en los estudios de imagen y principalmente en la tomografía. Sin embargo el papel que debe tomar la tomografía en el diagnóstico de la apendicitis aguda esta en controversia.

Objetivo: Conocer la sensibilidad, especificidad, valor predictivo negativo, valor predictivo positivo de la tomografía para el diagnóstico de apendicitis aguda. Conocer la influencia de esta practica sobre la incidencia de apendicectomías negativas. Comparar el diagnostico clínico (a través de la Escala de Alvarado) con el diagnostico por tomografía de apendicitis aguda

Material y Métodos: Este es un estudio retrospectivo de observación en el que se revisaron los expedientes de todos los pacientes a los que se les realizo apendicectomía en el centro médico ABC en un año, recabando las características clínicas que presento cada paciente y otorgándoles una puntuación en la escala de Alvarado y recabando los datos de la tomografía que sugieren apendicitis aguda. Se compararon ambas pruebas diagnosticas teniendo como estándar de oro para el diagnóstico, el reporte de patología.

Resultados: Se revisaron 357 expedientes, se excluyeron 96 y quedaron 261, se realizo tomografía en 162 pacientes (62%), se encontró una Sensibilidad (S) de la tomografía del 88% con un Valor Predictivo Positivo (VPP) 97%, con una Especificidad (E) del 50% y un Valor Predictivo Negativo (VPN)19%. Con un 2.8% de apéndices blancas en los pacientes con tomografía

Conclusión: Es recomendable para esta institución que en todo paciente que se sospeche de apendicitis aguda, con una escala de Alvarado menor a 7pts se realice tomografía, en aquellos que sea positiva que se les realice apendicectomía y en aquellos que sea negativa se mantengan en vigilancia.

Introducción

La apendicitis aguda es una de las enfermedades con resolución quirúrgica que mas frecuentemente se presenta en el servicio de urgencias, con una incidencia mundial estimada de 86 por cada 100,000 habitantes. A través del tiempo el deiagnostico de esta enfermedad ha presentado un gran numero de dificultades debido a que solo un porcentaje bajo de los pacientes tiene la presentación clínica clasica que se describe en la literatura, un dolor que inicia de modo difuso, epigástrico o periumbilicar que migra hacia la fosa iliaca derecha y que se acompaña de fiebre, anorexia, nausea y vomito. La triada clásica de apendicitis con un dolor abdominal que migra a la fosa iliaca derecha, dolor a la palpación en fosa iliaca derecha y leucocitosis, solo se presenta en aproximadamente 50% de los casos.

Este error diagnóstico "permisible" tiene dos posibles resultados, un porcentaje de apéndices blancos, es decir apendicectomías que se realizaron con sospecha de apendicitis pero que el diagnóstico de patología del apéndice la dio negativa (apendicectomía negativa) y un porcentaje de pacientes con apendicitis que pasa desapercibida a los que no se les realiza apendicectomía a tiempo y tienen alguna complicación secundaria a esto como es la perforación del apéndice.

La literatura mundial reporta apendicectomías negativas entre un 12 al 30%, aumentando en mujeres y menores de 12 años. Es aceptado en la práctica médica de cualquier cirujano que exista hasta un 15% de apendicectomias negativas.

La mortalidad y morbilidad de una apendicectomía con un apéndice sano va del 0.14 al 4.6%, de una apendicitis aguda es entre 1.7 y un 6.1% y de una apendicitis perforada entre el 1.7 y el 19%. El retraso en el diagnóstico tiene un costo elevado en cuanto a que aumenta los días de estancia intrahospitalaria, es por esto que tener un diagnóstico preciso tan pronto como sea posible reduce la morbilidad-mortalidad y los costos.

Ante esto se han propuesto distintas calificaciones que pueden hacernos tener un diagnóstico certero, mas temprano, que reduzca el porcentaje de apéndices blancos y de apendicitis perforada; Una de estas es la Escala de Alvarado (EA), una escala basada en hallazgos clínicos y de laboratorio descrita en 1985 por el Dr. Alfredo Alvarado en Florida, EU la cual otorga puntos para cada hallazgo con un máximo de 10 puntos siendo el mas cercano a 0 el de menor la probabilidad de apendicitis; A mayor puntaje mayor la probabilidad de tener apendicitis aguda, una calificación mayor o igual a 7 es suficiente para realizar una apendicectomía. (Tabla 1)

En épocas más recientes el avance de los estudios de imagen han aumentado nuestra sensibilidad y especificidad para el diagnóstico de la apendicitis de manera temprana, al identificar por imagen y de manera no invasiva el apéndice y los cambios que presenta cuando esta inflamado así como otras alternativas diagnosticas en las cuales se excluye el diagnóstico de apendicitis y se le da un diagnóstico a la causa del dolor abdominal.

Tabla 1: Escala de Alvarado	
Punto a evaluar	Puntaje
Síntomas	
Migración del dolor periumbilical hacia fosa ilíaca derecha	1
Anorexia	1
Náusea o vómito	1
Signos	
Dolor en cuadrante inferior derecho	2
Rebote a la palpación	1
Temperatura elevada ≥ 38 °C (100.4 °F)	1
Laboratorio	
Leucocitosis	2
Neutrofilia (>75%)	1
Aplicación del sistema de evaluación de Alvarado	
1-4	Altamente improbable
5-6	Posible (recomendable utilizar métodos de imagen)
7-10	Muy probable

Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986; **15**: 557-564
Khan I, Rehman A. Application of Alvarado scoring system in diagnosis of acute appendicitis. *J Ayub Med Coll Abbottabad* 2005

El ultrasonido (US) y la tomografía son actualmente los estudios de imagen mas utilizados en ayuda para el diagnóstico de apendicitis; El ultrasonido para el diagnóstico de apendicitis se introdujo por Puylaert en 1980 y tiene la ventaja de ser de bajo costo, relativamente accesible en la mayoría de los centros y que no emite radiación ionizante, con la desventaja de que es operador dependiente. En presencia de dolor abdominal muchos de los pacientes tienen una importante cantidad de gas y asas muy distendidas lo cual limita la eficacia del ultrasonido y en pacientes obesos disminuye su eficacia.

La tomografía en cambio no tiene ninguna de las limitaciones anteriores teniendo como desventaja el emitir radiación ionizante lo cual repercute más en pacientes embarazadas y menores de 10 años de edad ya que son más susceptibles a la radiación;

Fuera de este grupo de pacientes la tomografía computada, principalmente la helicoidal, han tomado un papel protagónico en el diagnóstico de la apendicitis aguda, reportando sensibilidad que va del 90 hasta el100% y una especificidad que va del 91 al 99% en su modalidad con doble contraste.

En la actualidad algunos médicos se apoyan en la tomografía para el diagnóstico de la apendicitis en aquellos pacientes que tienen una cuadro clínico no clásico pero con sospecha diagnóstica de apendicitis. Al tratar de establecer a que pacientes deberían solicitarles una tomografía se establecieron algunos parametros que utilizaron la escala de Alvarado, en los cuales se establece que con 7 o mas puntos no es necesaria la tomografía ya que por si misma tiene una sensibilidad del 77% y una especificidad del 100% pero de 4-6 puede tener un impacto importante para disminuir las apéndices blancas y las apendicitis perforadas con una sensibilidad del 90% y una especificidad del 95%.

Sin embargo debido a la alta sensibilidad y especificidad de la tomografía se ha entrado en la controversia de si todos los pacientes con sospecha de apendicitis deberían de ser sometidos a una tomografía con reportes de que la tomografía por si sola puede disminuir las apéndices blancas hasta el 4% con una sensibilidad como prueba diagnostica del 90% y especificidad del 99% con valores predictivos positivos del 98%; Esto ha llevado a que autores como Nelson DW en un articulo (Am J Surg. 2013 Apr;205(4):452-6 j.amjsurg.2012.07.038. Epub 2013 Feb 4) publicado recientemente en la revista de cirugía americana, se cuestione el papel de la clínica en comparación con la tomografía en el diagnóstico de apendicitis concluyendo que aunque la exploración clínica continua siendo

esencial la tomografía se ha vuelto una modalidad muy importante para establecer el manejo de los pacientes a los que se sospecha de apendicitis

En el Centro Medico ABC, un hospital privado de la ciudad de México, el uso de la tomografía como apoyo para el diagnóstico de apendicitis aguda ha venido utilizándose con mayor frecuencia para tomar una decisión en cuanto al tratamiento para los pacientes con sospecha de apendicitis aguda. Por este motivo se realizo el presente estudio en el cual evaluaremos la sensibilidad y la especificidad de la tomografía en esta institución.

Existen factores importantes a tomar en cuenta con respecto a la institución donde se realizó este estudio; Es una institución privada, lo que implica que los gastos de la atención medica son absorbidos por los pacientes o sus aseguradoras, los pacientes acuden a este hospital son predominantemente de clases sociales económicas media-alta y alta, el papel que han tomado recientemente las aseguradoras en la atención médica de los pacientes y por último que el numero de reclamos y demandas médicas en este medio son mayores que en los hospitales públicos.

Posiblemente lo mencionado obliga a tener un juicio diagnostico mas estricto y el tratamiento adecuado. Quizá estas razones influyan en que algunos médicos usen con mayor frecuencia la tomografía, en el presente estudio evaluamos el papel de la tomografía comparándolo con la clínica.

Marco Teórico

Historia del apéndice y la apendicitis aguda

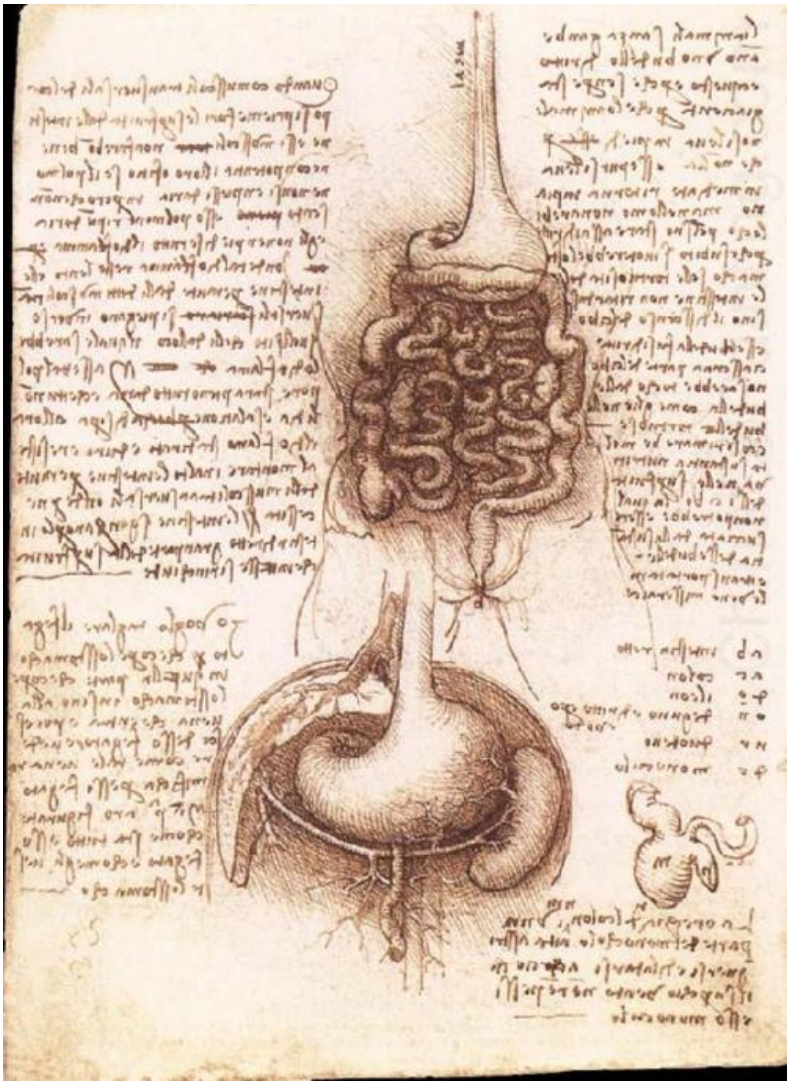
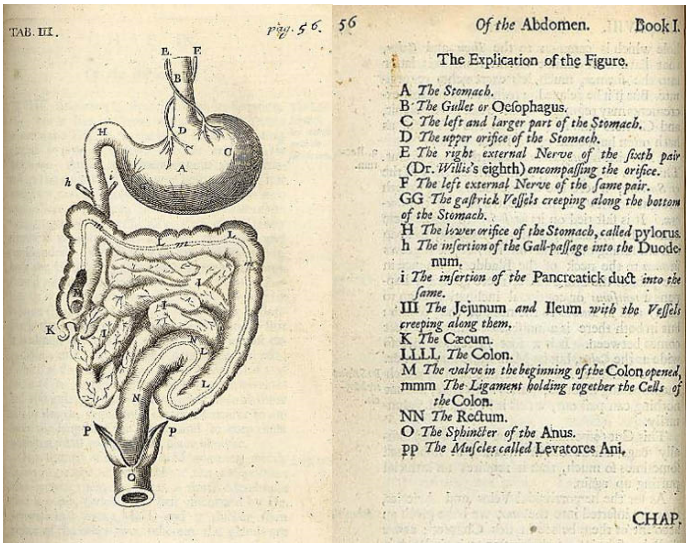


Ilustración de Leonardo Da Vinci (1510): En el borde inferior derecho encontramos la unión del ileon con el colon, el ciego con una letra “m” y el apéndice (al cual no conocía como apéndice) con una letra “n”

Berengarius Carpus profesor de cirugía en Pavia y Bologna, Italia, fue el primero en describir el apéndice, lo menciona como un aditamento al final del ciego que drena a la luz del mismo, mas pequeño que el dedo mas pequeño de la mano y aproximadamente de tres pulgadas de largo, posteriormente, Da Vinci la ilustro por primera vez y veintiún años después, Vesalio lo describió e ilustro.


TAB. III. pag. 56. 56 Of the Abdomen. Book I.

The Explication of the Figure.

A *The Stomach.*
B *The Gullet or* Oesophagus.
C *The left and larger part of the Stomach.*
D *The upper orifice of the Stomach.*
E *The right external Nerve of the sixth pair* (Dr. *Willis's* eighth) *encompassing the orifice.*
F *The left external Nerve of the same pair.*
GG *The gastrick Vessels creeping along the bottom of the Stomach.*
H *The lower orifice of the Stomach, called* pylorus.
h *The insertion of the Gall-passage into the* Duodenum.
i *The insertion of the* Pancreatick duct *into the same.*
III *The* Jejunum *and* Ileum *with the Vessels creeping along them.*
K *The* Cæcum.
LLLL *The* Colon.
M *The valve in the beginning of the* Colon *opened.*
mmm *The Ligament holding together the Cells of the* Colon.
NN *The* Rectum.
O *The Sphincter of the* Anus.
pp *The Muscles called* Levatores Ani.

CHAP.

Gibson, Thomas (1647-1722), The anatomy of humane bodies epitomized

Una de las primeras ilustraciones del apendice la realizo Da Vinci en 1492 (aproximadamente) y la nombro “orechio” o pequeña oreja; Al principio se confundía el apéndice con el ciego ya que Vesalio nombro al apendice como ciego debido a su fondo ciego, no fue hasta que Ambroise Pare (1582) realizo la distinción, mencionando que existía el ileon el ciego y el apéndice.

Fallopius en 1561 fue el primero en compararlo con un gusano y de ahí el nombre de apéndice vermiforme, posteriormente varios autores (Laurentiue 1600; Morgani 1706; Verheyn, 1710; Santorini, 1724; Vosse 1749; Weitbrecht, 1747; Haller, 1778; y Sapatier, 1781) discutieron sobre su posición habitual, sobre sus capas y sobre su función.

Gerlach en 1824 describió sus válvulas como pliegues de la mucosa o membranas que ocluían la luz del apéndice

Treitz en 1857 describió la fosa cecal pero fue hasta 1891 con los trabajos de Lockwood y Rollstone que se describieron los pliegues peritoneales que lo involucraban, por último Clado describió un ligamento que va del ovario al mesoapendice.

En cuanto a la clínica se dice que Hipócrates ya conocía sobre los abscesos apendiculares ya que mencionaba que "un dolor prolongado de la región de los intestinos asociada a pus, era algo malo" y Peter Lowe en 1612 sugirió que Hipocrates murió de este padecimiento. Celso y Galeno se referían a los dolores del abdomen como la cólera ileaca o la cólera cólica distinguiendo la iliaca como un dolor por arriba del ombligo y la cólica como un dolor por debajo del ombligo que migraba a la derecha y que con frecuencia recurría.

Fernelius en 1567 describió el caso de una niña de 9 años con dolor abdominal y diarrea a la cual su abuela y las ancianas del pueblo decidieron darle membrillo por sus propiedades astringentes; Al día siguiente la niña inicio con vomito y posteriormente murió. Se le realizo una autopsia que mostró una semilla de membrillo ocluyendo el apéndice, el cual se encontró perforado por arriba de la obstrucción y material "corrupto" diseminado en el

abdomen. Habitualmente en estos casos se culpaba a la válvula ileocecal y también se mencionaba que los cadáveres olían tan mal que realmente no se tomaban su tiempo para examinarlos a fondo.

Saracenus en 1642 describió una paciente con un absceso en el cuadrante inferior derecho que posteriormente se exteriorizo en forma de una fístula cecal, el paciente sobrevivió; esta puede ser la explicación de por que algunos de los pacientes algunos de los pacientes sobrevivían a cuadros de apendicitis en esa época.

En 1661 Sydenham describió que en el inicio de esta patología el dolor era difuso y posteriormente se fijaba a un solo punto y menciono que la causa era distinta a otras patologías abdominales como volvulus intususcepción o hernia estrangulada

En 1709 Boerhave menciono que debemos ser cautos con los dolores cólicos del abdomen, no todos son consecuencia del viento, del frío o de los flatos que no pasaron y en algunos casos pueden tener consecuencias letales; Herlin en 1768 en una serie de autopsias encontró distintos objetos y materias obstruyendo la luz del apéndice entre ellas gusanos, piedras, bolas de plomo (que se usaban para la obstrucción intestinal) y piedras fecales

En el siglo XIX se inicio la tendencia de reportar series en lugar de casos individuales Parkinson en Londres en 1812 fue de los primeros en publicar una serie y con esto el avancé de la medicina y la agrupación de síndromes se presento de manera mas fácil y mas frecuente. Fue en esta época que la controversia sobre el origen del dolor de la fosa iliaca derecha se convirtió en debate, se le dieron distintos nombres como la tiflitis estercoral, la

tiflitis simple, la peritiflitis, pericaecitis entre otras, fue hasta 1886 que Reginald H Fitz en una serie de 257 pacientes demostró que los pacientes con tiflitis y peritiflitis mostraban exactamente los mismos síntomas que los pacientes con apéndices perforados y dijo que la fuente del mal en todos los casos con dolor en fosa iliaca derecha era el apéndice. Fue en esta descripción y en un posterior articulo de Matterstock en Alemania se menciono por primera vez el termino apendicitis.

En 1889 McBurney contribuyo describiendo su signo clásico de McBurney para el diagnóstico de apendicitis, posteriormente hubo numerosos reportes sobre la bacteriología de la apendicitis. De este punto en adelante la atención se centro más en el tratamiento que en el diagnóstico.

Desde los tiempos antiguos de la medicina se seguía el famoso dicho de “absceso drenado absceso curado” El drenaje de todos los abscesos de la fosa iliaca derecha y del colon llevó a distintos resultados, de todas formas resultando en la mayoría de los casos con la muerte del paciente y la discusión se centraba en drenar tempranamente o tardíamente; Se acostumbraba el uso de eméticos para los dolores del abdomen superior y de laxantes para los del abdomen inferior. También se intentaron píldoras o esferas de plomo y enemas para tratar la obstrucción intestinal; Her Von Helmont recomendó para el tratamiento de la cólera iliaca el tragar las balas de plomo de un mosquete o bayonetas, este tratamiento se siguió usando hasta alrededor de los 1800’s.

Orisbasius y los médicos árabes recomendaban abrir los abscesos de los intestinos; fue hasta 1735 que Claudius Amyand describió la primera resección quirúrgica del apéndice localizado dentro del saco de una hernia inguinal.

Al parecer fue Mestivier en 1759 el primero en abrir intencionadamente un absceso apendicular; Hancock en 1848 es el primero en reportar una laparotomía para tratar supuración periapendicular antes de que se formen adherencias dentro del abdomen y de ese modo logro una muy buena recuperación en su paciente, Lewis en 1856 repitio la recomendación de Hancock pero basado en una serie de 40 pacientes operandolos entre el día 11 a 14 después del dolor; en 1867 Willard Parker con el apoyo de los avances en la antisepsia de Sir Joseph Lister propuso operar antes del día 7.

La introducción del uso de dosis altas de morfina por Graves y Stokes en esas mismas épocas provoco cambios acelerados en las técnicas quirúrgicas y también en 1859 Chassiagnae introdujo los tubos de drenaje después de una intervención por abscesos de origen apendiculares.

En 1882 se discutía si la laparotomía se podría realizar aun antes de que supurara el apéndice y es hasta esta época que Samuel Fenwick y Mickuliez de Markow postularon como tratamiento cortar directamente el apéndice en una laparotomía tan pronto como se haga el diagnóstico, ligar por debajo de la perforación, retirar el apéndice y todo tejido muerto circundante que pueda generar irritación.

Kronlein en 1884 removió el apéndice de manera aguda a través de una incisión medial pero con malos resultados para su paciente. En 1886 Reginald Fitz, patólogo de Harvard fue el primero en proponer que la apendicectomía como tal es el tratamiento ideal de la apendicitis aguda; Sands en 1887 fue el primero en resecar quirúrgicamente el apéndice dentro de un absceso con resultados satisfactorios para su paciente, sin embargo el realizo este procedimiento sin saber que el apéndice era el origen de la patología de su paciente; En 1888 Treves realizo la primera apendicectomia de intervalo (Drenar el absceso en un tiempo quirúrgico y resecar el apéndice en un segundo tiempo)

El primero de junio de 1887, Thomas G. Morton, de Filadelfia fue el primero en reportar dos casos de extracción del apéndice desde su base, teniendo una sospecha diagnostica previa de enfermedad específica del apéndice con éxito y buenos resultados para sus pacientes.

Después de esto se fueron refinando tanto el diagnostico como las técnicas quirúrgicas, fue en 1893 que Mc Burney reporto su famosa técnica y la incisión que lleva su nombre se popularizo; posteriormente aparecieron mas técnicas quirúrgicas y una gran cantidad de signos clínicos que permanecen hasta la actualidad.

Otra modalidad en la técnica quirúrgica fue el inicio de la laparoscopia, la primera apendicectomía por laparoscópica, se atribuye a Kurt Semm en 1980 en Frankfurt Alemania.

Anatomía y embriología

Embriología

El apéndice se distingue a la semana 8 de gestación como una proyección del ciego que mas delgada que este, al nacimiento es 4.5 veces menor en ancho que el ciego y en la edad adulta hasta 8.5 veces, durante el desarrollo prenatal el apéndice y las tenias tienen una rotación medial lo que falla en 5-15% de las personas las cuales tendrán una situación y posición diferente del apéndice.

Alrededor de la semana 12 se podrá encontrar tejido linfoide asociado a la mucosa del apéndice y esta aumentara gradualmente hasta tener un pico de crecimiento en la pubertad y después descenderá, de ahí que se considera que la función del apéndice sea la de un órgano linfoide.

Malformaciones congénitas

En general son raras, el apéndice es un órgano bastante constante, se puede encontrar ausencia del apéndice por agenesia lo cual es my raro, pero también por autoimplantación en la pared del ciego donde aparentaría ser una cuarta austra, se puede intusuceptar o momificarse; también puede tener una localización ectópica casi siempre asociado a defectos de malrotación, y defectos diafragmáticos, se ha encontrado en el tórax, en el hemiabdomen izquierdo, subhepático y en la región lumbar; Aun menos frecuente es un doble apéndice lo cual se presenta casi siempre asociado a malformaciones del ciego pero se puede presentar un doble apéndice por si mismo o un apéndice que se duplique cerca de la punta con una apariencia bífida

Otras variaciones al apéndice habitual son la presencia de divertículos en el apéndice o la presencia de mucosa ectópica gástrica o esofágica y tejido pancreatico

Topografía, posición y relaciones anatómicas

El apéndice nace del ciego, y se relaciona posteriormente con el psoas, anterior y lateral con la pared abdominal y medial con el ileon terminal o el epiplón, sin embargo la posición del ciego y del apéndice varia con la posición del paciente, si esta de pie probablemente baje al anillo pélvico y en otras posiciones puede subir en dirección del hígado y se puede adherir cuando esta inflamado a prácticamente cualquier órgano abdominal excepto a los del cuadrante superior izquierdo.

Topográficamente se encuentra en la fosa iliaca derecha, las posiciones que puede tomar el apéndice son principalmente retrocecal, retrocolico, pélvico, subsecal, ileocecal anterior e ileocecal posterior, la mas frecuente es la retrocecal, sin embargo existe mucha confusión con este termino ya que la genete lo asocia con estar ó no por debajo del peritoneo y estos términos no se refieren a eso.

Capas del apéndice

El apéndice cuenta con una serosa, muscular longitudinal, muscular circular, una submucosa donde esta el tejido linfoide asociado a la mucosa y una mucosa. Tiene un epitelio cilíndrico y células M (presentadoras de antígenos de membrana).

Existen también válvulas dentro del apéndice llamadas válvulas de Gerlach.

Mesenterio del apéndice

Si bien no tiene un mesenterio real la irrigación del apéndice viene de un pliegue peritoneal por donde pasa la arteria apendicular y es a este que todos nos referimos como mesoapendice

Morfología del apéndice

Algunas mediciones relativamente constantes del apéndice son que se origina del ciego donde termina las tenias y a 1.7cm (promedio) de la válvula ileocecal, la base del apéndice mide de diámetro entre 0.5-1.5cm, el largo varia entre población y población con un rango de 6-12cm en promedio y el volumen intraluminar promedio del apéndice es de 0.1ml.

Vascularidad

Se irriga por la arteria apendicular la cual casi siempre viene de la arteria ileocólica sin embargo puede originarse de una rama ileal o una cecal y la base del apéndice casi siempre se irriga por una rama cecal anterior o posterior, la duplicación de arteria apendicular ocurre en el 10% de las personas y en gente hindú aumenta hasta el 30%.

El drenaje venoso lo realiza la vena apendicular que atraviesa el "mesoapendice" y confluye con la cecal drenando a la ileocecal.

El drenaje linfático sigue el trayecto de las arterias y termina en los ganglios celiacos y en la cisterna del quilo.

Inervación

Proviene, la parte simpática, de los ganglios celiacos y mesentéricos superiores, la parasimpática del vago y la sensorial de los nervios espinales torácicos 8 y 9 en ocasiones 10 y 11 también

Apendicitis aguda

Epidemiología

Es la cirugía de urgencia mas común en el mundo, con una incidencia de 100 de cada 100,000 personas en Europa y America con apendicitis perforada en 20 de cada 100,000 personas y un pico entre los 10-19 años de edad. En estados unidos 260,000 personas al año serán sometidas a apendicectomía y 15% de estas serán apendicectomía negativas, lo cual representa 1,000,000 de días de estancia intrahospitalaria al año. El porcentaje habitual de apendicectomías negativas varia en cada centro pero se calcula de aproximadamente 15.3% (mujeres 22%, hombres 9.3%), el 40% ocurren entre los 10 y 29 años. Se calcula que aproximadamente el 12% de los hombres y el 22.3% de las mujeres de la población serán apendicectomizados en el transcurso de su vida.

Es mas frecuente en hombres, la relación hombre: mujer es de 1.4:1 en todos los grupos de edades y es más frecuente en caucásicos (1.5:1). El riesgo de presentar apendicitis durante la vida es de 8.6% en hombres y 6.7% en mujeres. Tiene una mortalidad en la actualidad <1% y se calcula que hace 100 años tenia una mortalidad de aproximadamente 60%.

Bacteriología

Los microorganismos más frecuentes presentes en el apéndice son los de la flora habitual del colon, las principales bacterias presentes en la apendicitis aguda son Bacteroides Fragilis y E. Coli; El cultivo de rutina es controversial, se recomienda en inmunocompromidos ó abscesos residuales. La elección de antibióticos para el postoperatorio es controvertida, en apendicitis aguda no complicada se pueden no usar antibióticos y en el caso de las complicadas sobre todo aquellas complicadas con perforación se prefieren antibióticos de amplio espectro y una segunda controversia es el tiempo que se administraran los mismas variando de 24-48hrs hasta quienes prefieren mantener antibióticos por 7-10 días.

Diagnostico

Si bien la presentación clínica puede variar considerablemente, sobretodo en los pacientes en los extremos de la vida (< 5 años y >65años), el síntoma pivote es el dolor abdominal; Clásicamente inicia con un dolor mal definido en el epigastrio o periumbilical, constante, en ocasiones con cólicos, posteriormente, después de 1-12 hrs (4-6 promedio), migra a la fosa iliaca derecha. Sin embargo la expresión del dolor puede variar dependiendo de la posición de la punta del apéndice. (Los retroileales pueden dar dolor testicular por irritación del uréter y arteria espermática, aquellos retrocecales pueden dar lumbalgias, etc.)

El síntoma que se presenta con mayor frecuencia es la anorexia; la nausea y el vomito también son frecuentes, pero no son muy intensos ni prologado y generalmente aparecen después del dolor (si lo precede hay que dudar del diagnostico de apendicitis aguda) por

estimulo neural, por distensión ó por íleo. Puede haber tanto diarrea como obstipacion ó sintomas urinarios. La secuencia clásica es anorexia, dolor abdominal difuso que migra a fosa iliaca derecha, posteriormente nausea y vomito seguida de fiebre.

Los signos vitales cambian poco siendo la taquicardia leve el cambio mas frecuente, la temperatura se eleva en promedio 1ºC y la presencia de fiebre se asocia a un mayor tiempo de evolución. Habitualmente el paciente prefiere estar en posición supina con la pierna derecha doblada o en posición antialgica con las dos piernas flexionadas.

Los signos de a la exploración del abdomen como son McBurney, Rovsing, hiperestesia/hiperbaralgesia de T10-T12 (Estos últimos pueden ser el primer signo) y resistencia abdominal son los mas frecuentes, aunque se han descrito muchos otros signos de apendicitis aguda.

Los hallazgos de laboratorio más frecuentes son la leucocitosis y el predominio de polimorfonucleares y neutrofilia. En apéndices retroileales o pélvicos se puede encontrar alteraciones en el examen general de orina por irritación de la vejiga y el uréter.

Se han realizado distintas escalas que agrupan estos hallazgos clínicos y de laboratorio para diagnosticar con mayor certeza la apendicitis aguda, una de estas es la Escala de Alvarado que evalúa si los síntomas, signos y hallazgos de laboratorio otorgando un puntaje de 0-10; A mayor puntaje mayor la probabilidad de apendicitis aguda y con 7 o más puntos se recomienda realiza la apendicectomía. (Tabla 1 en la introducción).

Sin embargo debido a que la clínica no siempre tiene una presentación clásica la apendicitis aguda sigue representando un reto diagnostico para lo cual nos apoyamos en los estudios de imagen como las radiografías de abdomen, el ultrasonido y la tomografía en sus distintas modalidades (helicoidal, axial computada, etc.)

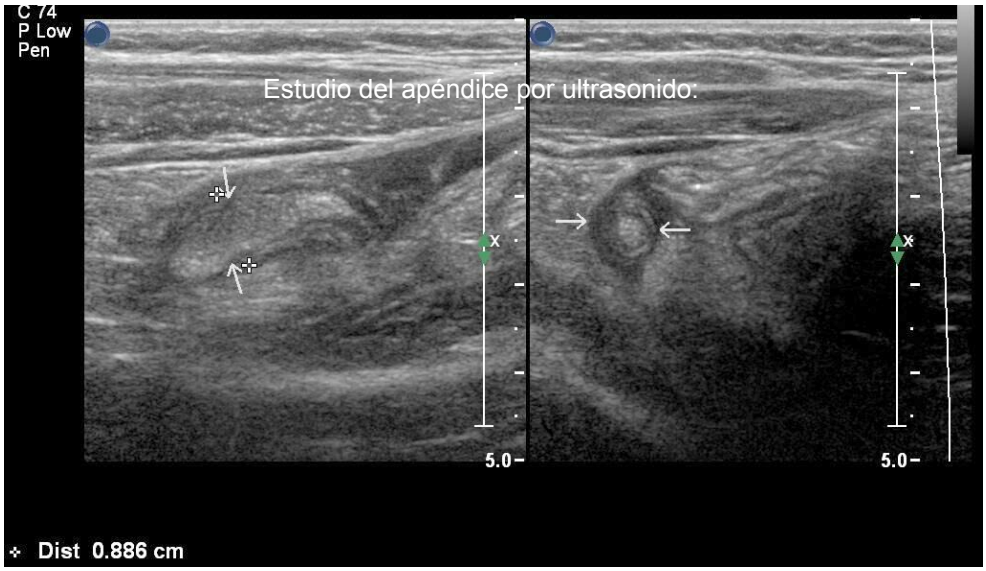
Radiografías de abdomen

Aunque se han descrito distintos hallazgos en las radiografias de abdomen que se asocian a apendicitis aguda como la presencia de un fecalito, estos hallazgos se encuentran en un porcentaje muy bajo de los casos y en general son hallazgos inespecíficos por lo cual la radiografía de abdomen con el fin de diagnosticar apendicitis ha entrado en desuso. Los estudios baritados en los que si se llena el apéndice se descarta una apendicitis aguda han sido ampliamente sustituidos por el ultrasonido y la tomografía.

Ultrasonido

El ultrasonido ha reportado una sensibilidad del 55-96% y especificidad del 85-98%. Técnicamente se localiza el apéndice (una asa ciega aperistáltica) y se intenta comprimir, si se obtiene resistencia y no se comprime, así como el hallazgo de imágenes sugerentes de fecalitos o imagen en diana son sugerentes de apendicitis aguda y un diámetro mayor a 6mm en compresión máxima se considera positivo; Si esta normal y se comprime excluye el diagnostico. El estudio es inconcluso si no se localiza el apéndice, inflamación o líquido.

Muchas veces se prefiere por ser económicamente accesible, no invasivo y tener una buena sensibilidad y especificidad, sin embargo al ser un estudio operador dependiente y que su sensibilidad y especificidad bajan dramáticamente en pacientes obesos y aquellos con mucha distensión abdominal no se puede considerar como el estudio de elección pero es un gran apoyo diagnostico.



En el lado izquierdo un corte longitudinal del apéndice con 8.86 mm de diámetro en compresión máxima, del lado derecho un corte transversal del apéndice mostrando la clásica imagen en diana

Tomografía para apendicitis aguda

La tomografía se ha vuelto el estudio de elección para diagnostico de apendicitis aguda, en los casos en que la clínica no es habitual, debido a su alta sensibilidad 93-98% y su capacidad para detectar complicaciones o identificar diagnósticos diferenciales de dolor abdominal. La tomografía computada helicoidal con cortes de 5mm es la que con mayor

frecuencia se usa, y se puede realizar en distintas modalidades, simple, con contraste intravenoso con contraste oral o con contraste transrectal, si bien que protocolo es el que se prefiere esta aun en controversia. El uso de la tomografía sin ningún tipo de contraste es suficiente para el diagnóstico en la mayoría de los casos con la ventaja de no exponer a los pacientes a los riesgos que conlleva el uso de contraste y la rapidez con la que se realiza este estudio. La ventaja de los estudios contrastados es que ofrece una mayor sensibilidad y especificidad además de una visualización anatómica más completa.

Por tomografía el apéndice sano (figura 1) se aprecia como una estructura tubular de fondo ciego de bordes regulares y con un diámetro menor a 6mm, aunque en 25-48% de las ocasiones no se logra identificar el apéndice cuando está sano.

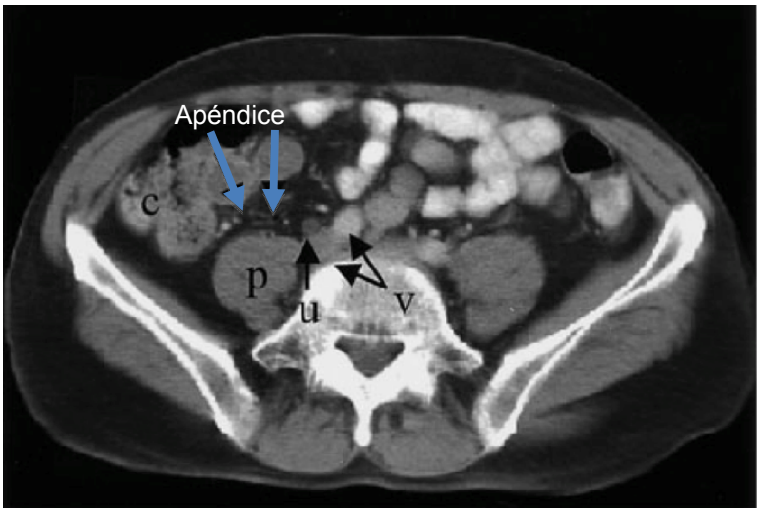


Figura 1:
Apéndice normal
c: ciego
p: Psoas
u: Uréter
v: Vasos

El apéndice cuando se encuentra inflamado, es decir con apendicitis aguda pero no complicado puede presentar distintos hallazgos; Es común que su luz este ocupada por liquido (figura 2), pared engrosada con captación del contraste IV con un diámetro mayor a 6mm (aunque para algunos autores consideran que para ser positivo tiene que medir mas de 10mm; se acepta que mas de 6mm es anormal), la presencia de un apendicolito (Figura 3 y 4), estriamiento de la grasa pericecal (figura 5) y algunos hallazgos indirectos como el engrosamiento del peritoneo cercano (fascia lateroconal), cambios inflamatorios pericecales y adenopatías (pericecales ó del mesenterio del ileon terminal). Los hallazgos cuando hay una apendicitis complicada son habitualmente asas de delgado adheridas al apéndice, plastrones o masas de apariencia inflamatoria, colecciones o puede no identificarse el apéndice.

Es importante tener en cuenta patologías que pueden dar los mismos hallazgos por tomografía como diagnósticos diferenciales, como los tumores apendiculares (carcinoides, mucoceles, etc.), enfermedad de Crohn, divertículo de Meckel, enfermedades ovaricas o ginecologicas (Enfermedad pélvica inflamatoria, embarazo ectopico), diverticulos cecales y apéndagitis epiploica entre otros. Otro factor a considerar es que en individuos muy delgados con escasa grasa intra-abdominal aumentan los falsos negativos.

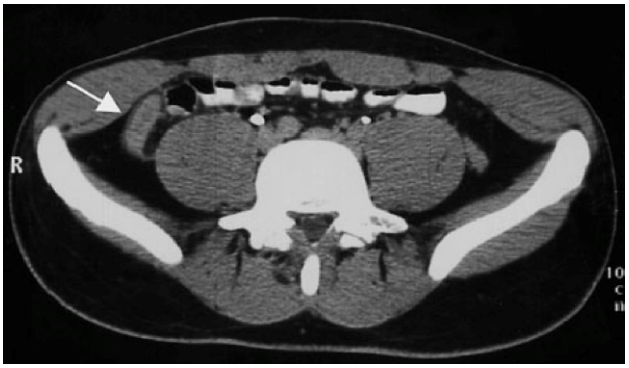


Figura 2:
Apendicitis aguda
Diametro 11mm

Figura 3:
Apendicolito sin cambios inflamatorios

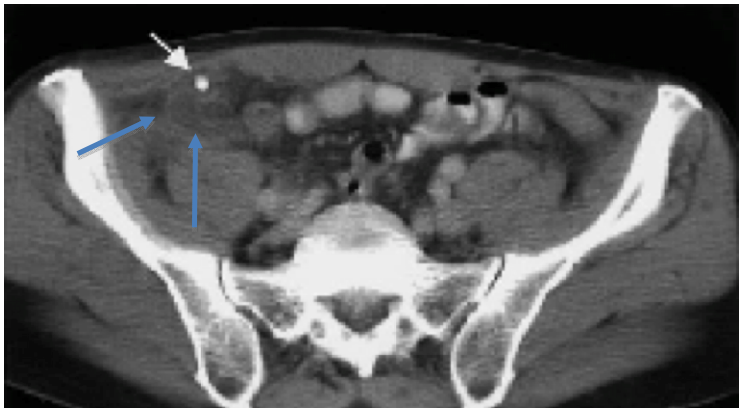


Figura 4:
Apendicolito con cambios inflamatorios (Flechas azules)

Figura 5:

Engrosamiento de la fascia lateroconal (flechas blancas)

Estriación de la grasa (Flecha azul)

Todos estos hallazgos se conjuntan para dar el diagnostico de apendicitis aguda, esto con una alta sensibilidad y especificidad superiores al 90% y un valor predictivo positivo y negativo superiores al 90%. Pero ¿que significa esto en cuanto a la apendicitis aguda y su diagnostico? La sensibilidad es la capacidad de una prueba diagnostica para dar como positivos los casos en los que realmente esta enfermo el paciente, es decir es la capacidad de reconocer a los pacientes que tienen apendicitis aguda; La especificidad es la capacidad de una prueba diagnostica de dar como negativos los casos en los que realmente este sano el paciente, es decir la capacidad de reconocer a los pacientes sanos;

El valor predictivo positivo es la probabilidad de tener la enfermedad una vez que la prueba dio positiva, es decir si la tomografía dio positiva para apendicitis ¿cual es la probabilidad de que realmente tenga apendicitis?; El valor predictivo negativo es la probabilidad de estar realmente sano una vez que la prueba dio negativa, es decir si la tomografía dio negativa ¿cual es la probabilidad de que el apéndice este sano?

Tratamiento

El tratamiento es quirúrgico, la resección del apéndice (apendicectomía) y drenaje de los abscesos es el único tratamiento definitivo.

Existen distintas incisiones en la técnica abierta y existe la técnica laparoscópica de la cual ahondaremos más adelante.

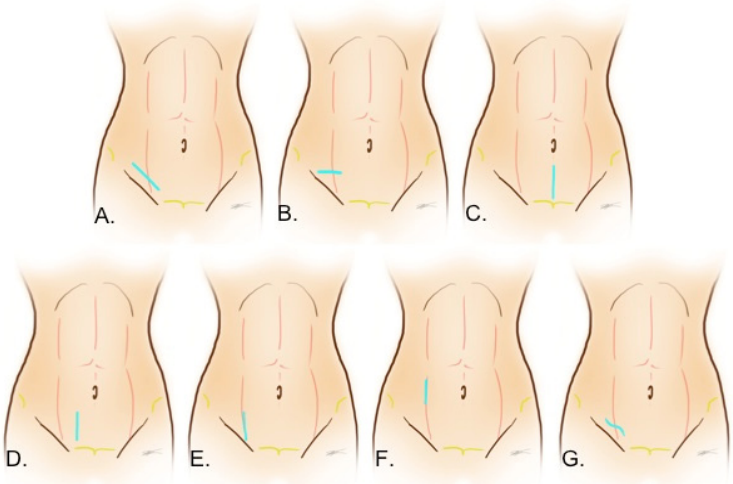
En la técnica abierta la incisión mas frecuente es la tipo Rockey-Davis o Mc Burney, en alrededor de 35% de todos los casos el apéndice estará a menos de 5cm del punto de Mc

Burney y 15% a mas de 15 cm por lo cual es no solo una buena guía para la exploración si no también para planear el abordaje quirúrgico. Una vez incidida la piel y atravesada la pared muscular se debe de buscar el ciego, seguir las tenias del mismo y donde confluyen estará la base del apéndice, la frecuencia de ausencia del apéndice es muy baja por lo cual no se debe de asumir de primera instancia que no tiene apéndice si no se encuentra fácilmente.

Durante el embarazo hay que tomar en cuenta que el apéndice asciende junto al ciego gradualmente con el avance del embarazo hasta estar a la altura de L1-L2

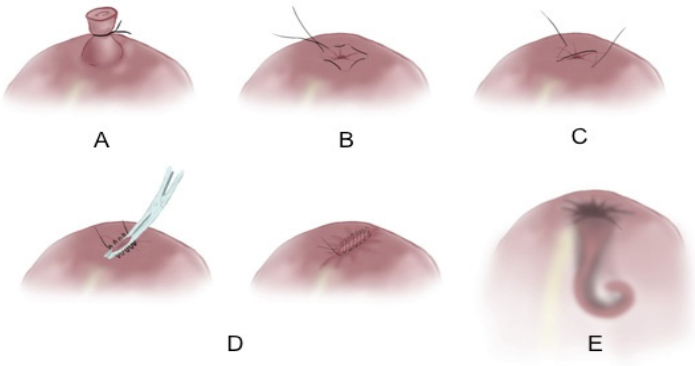
El manejo del muñón apendicular se pude realizar de distintos modos sin tener ninguna ventaja de uno sobre otro aunque prefiriendo la Parker-Ker en los casos en los que se afecte la base. Sin embargo en la era laparoscópica se ha visto que el manejo del muñón, mientras este bien ligado, no es tan relevante invaginar o dar puntos especiales al mismo y en los casos de la base muy afectada algunos cirujanos prefieren resecar el apéndice seccionándolo con una engrapadora lineal laparoscópica.

Incisiones en apendicectomía abierta	
Incisión	Descripción
McBurney (Gridiron)	Incisión oblicua sobre el punto del McBurney en sentido paralelo a las fibras del músculo oblicuo externo
Incisión en línea media infraumbilical	Incisión vertical en línea media por debajo de la cicatriz umbilical hacia la sínfisis del pubis
Rocky-Davis	Incisión transversa sobre el punto de McBurney separando los músculos de la misma forma
Jalaguier	Incisión vertical pararectal abriendo la vaina del músculo recto abdominal
Incisión paraumbilical derecha	Incisión vertical en línea para media dividiendo los músculos abdominales
Battle	Incisión paramedial derecha
Meyer	Incisión en forma de S de cresta iliaca anterosuperior a pubis
Lennander	Incisión pararrectal interna
Lecène	Incisión suprailiaca que inicia a 2 cm por encima y detrás de espina iliaca anterio superior y paralela a cresta iliaca aproximadamente a 8 cm



A.- Mc Burney, B.- Rocky-Davis, C.- Media infraumbilical, D.- Paramédia, E.- Pararectal, F.- Paraumbilical, G.- Meyer

Técnicas de cierre de Muñón en Apendicectomía	
Técnica	Descripción
Pouchet	Cierre de muñón
Halsted	Jareta, se invagina muñón sin cerrarlo
Parker Ker	Greta en zig-zag y posteriormente se regresa con surgete
Zukerman	Se invagina muñón en "Z"
Oshner	Cierre y jareta invaginante de muñón (Pouchet + Halsted)
Anton-Lilly	Invaginación completa de apéndice hacia ciego



A.- Pouchet, B.- Halsted, A + B = Oshner, C.- Zuckerman D.- Parker-Ker, E.- Anton Lilly

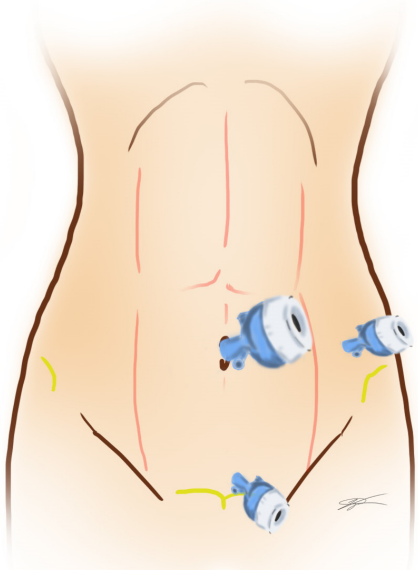
Las complicaciones de una apendicectomía abierta son bajas variando de entre el 1-3% y principalmente se presenta infección de herida quirúrgica (dependiendo el grado de la infección, siendo mas frecuente en apendicitis complicadas), sin embargo se pueden presentar hemorragias o hematomas al ligar la arteria apendicular de manera inadecuada y dependiendo de la posición del apéndice se puede presentar otras complicaciones como lesiones a asas de intestino (donde se puede adherir el apéndice), lesión del ciego (por tracción excesiva ya sea en la zona de la tracción en las zonas de fijación del ciego al peritoneo o velos de Jackson), lesiones vasculares, en particular iliacas, lesiones nerviosas (nervios torácicos espinales 10-12 en el momento de la incisión inicial o lesión al nervio ilio-hipogastrico) que pueden dejar parestesias que habitualmente sede en los 2-3 meses posteriores y abscesos residuales.

Apendicectomía laparoscópica

Si bien aun existe en estas épocas controversia sobre la superioridad de la técnica abierta sobre la laparoscópica o viceversa no es la intención de este escrito evaluarla por lo cual solo se describe la técnica quirúrgica

La técnica laparcoscópica se realiza habitualmente con tres puertos dos de trabajo y uno para la cámara habitualmente el transumbilical, la posición de los puertos de trabajo varia según el cirujano pero habitualmente hay uno en el flanco izquierdo a la altura de la cicatriz umbilical (este es el mas constante) y uno ya sea contralateral a la misma altura o

suprapúbico y en ocasiones con los dos puertos de trabajo suprapúbicos, el cirujano se posiciona al lado izquierdo del paciente al igual que su ayudante con los monitores frente a ellos.



Se identifica el apéndice y se tracciona hacia la pared abdominal exponiendo su mesoapendice el cual se liga ó fulgura y secciona con la arteria apendicular, se identifica la base del apéndice se liga y corta. En los caos en los que el apéndice es retrocecal y subperitoneal es necesario liberar el ciego de sus fijaciones peritoneales (Velos de Jackson) para liberar adecuadamente el apéndice y realizar la apendicectomía de forma segura.

Planteamiento del estudio

En este centro medico en el presente estudio se deben de tomar en cuenta lo siguiente:

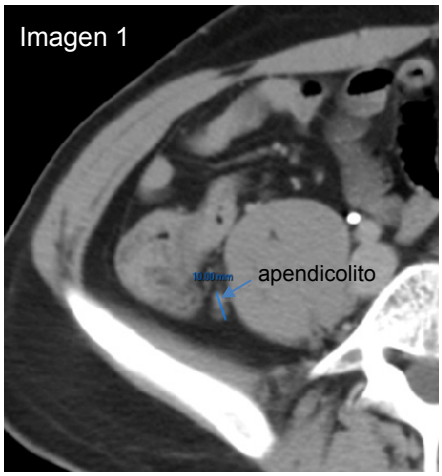
Existe una tendencia cada vez mayor a realizar tomografía siempre que se sospeche de apendicitis aguda y esto se ha realizado en los últimos años basados en los reportes de la literatura mundial sobre la alta sensibilidad y especificidad de la tomografía para el diagnóstico de la apendicitis aguda, Park JS et. al. (Am Surg. 2013 Jan;79(1):101-6.) reportaron una sensibilidad, especificidad, valor predictivo positivo y valor predictivo negativo de la tomografía en 96.4, 95.4, 95.6, y 96.3 % respectivamente y recomiendan el uso de rutina de ultrasonido ó tomografía siempre que se sospeche de apendicitis aguda.

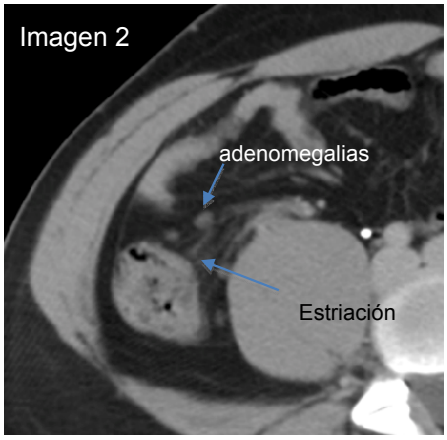
Además de la importante reducción que tiene para el número de apendicectomías negativas, Drake et. al. del Departamento de Cirugía de la universidad de Washington publico que en su programa de cuidados quirúrgicos y evaluación de resultados, que realizar tomografía a todos los pacientes en quienes se sospecha apendicitis reduce a la tercera parte la probabilidad de tener apendicectomías negativas con un porcentaje del 3-4.5% de apendicectomías negativas Vs 10-15.4% si no se realizara. Krajewski et. al. publicaron que no solo se reduce el porcentaje de apéndices blancos si no que además no varía la tasa de apéndices perforados, aun cuando ellos encontraron que realizar tomografía prolonga el tiempo que toma entrar a cirugía comparado con solo basarse en la clínica.

Ejemplificaremos la utilidad de la tomografía en tres casos clínicos:

Caso 1:

Paciente masculino de 35 años sin antecedentes de importancia, de edad con 8 horas de evolución con dolor moderado de inicio en Fosa Iliaca Derecha (FID), niega fiebre, hiporexia o algún otro síntoma, ala Exploración Física (EF) Signos vitales (SV) estables afebril, abdomen doloroso en región de fosa iliaca derecha punto de Mc Burney negativo, rebote negativo, resto de los signos negativos, Leucocitos de 7,500 sin bandas con 70% de segmentados. Tenia por escala de Alvarado solo 2 puntos (dolor en FID). Sin embargo su cirujano decidió realizar una tomografía con doble contraste en la cual se reporto un apéndice con 10mm de diámetro, con una imagen sugerente de fecalito en su interior (imagen 1), estriación de la grasa circundante y adenomegalias pericecales (imagen 2), diagnosticando apendicitis aguda. Se realizo una apendicectomía laparoscopia y el reporte de patología confirmo el diagnostico, apendicitis aguda.



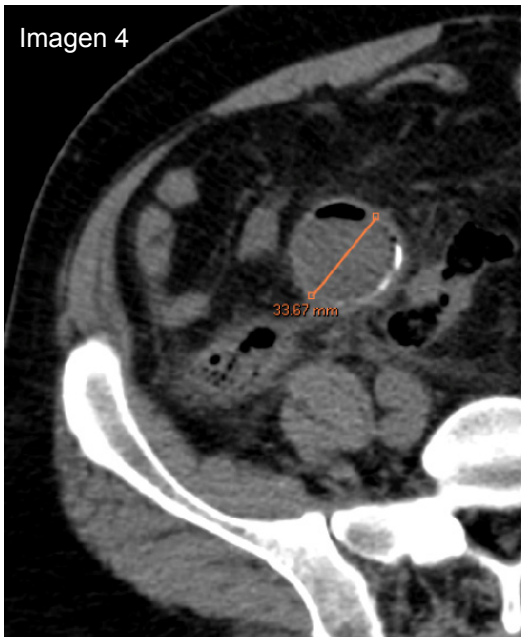


Caso 2:

Paciente masculino de 23 años sin antecedentes de importancia con 12h de evolución con dolor que inicio en hipogastrio y migro a fosa iliaca derecha incapacitante, acompañado de hiporexia y fiebre, a la exploración física tenia signos vitables estables afebril (36.3ºC), abdomen blando, peristalsis disminuida, dolor en fosa iliaca derecha, Mc Burney positivo, rebote positivo, resto de signos negativos. Leucocitos de 10,000 con 80%de segmentados y 2% de bandas, se le realizo la tomografía sospechando apendicitis aguda, la cual reporto un apéndice de 5mm de diámetro sin cambios inflamatorios (Imagen 3) y engrosamiento de la pared del ileon terminal por lo cual descartaron apendicitis aguda y sugirieron ileitis, sin embargo su cirujano debido a la clínica, con escala de Alvarado de 8 puntos, lo opero de cualquier modo, se le realizo una apendicectomía laparoscopica y patología reporto el apéndice como normal sin cambios inflamatorios.

Caso 3:

Paciente femenino de 43 años con antecedente de colecistectomía por laparoscopia un año previo y dolores pélvicos ocasionales intensos se presento con un cuadro de 24 h de evolución con dolor moderado tipo opresivo en fosa iliaca derecha, acompañado de nausea, hiporexia, astenia y adinamia, a la exploración física con signos vitales estables afebril, abdomen blando depresible peristalsis presente, rebote negativo, punto de Mc Burney positivo, talopercusion positiva, resto de los signos negativos, con Leu de 9,000 con 82% de segmentados y 1% de bandas, con lo que sumaba escala de Alvarado de 6 puntos. Se le realizo una tomagrafía de abdomen contraste IV que reporto un apéndice de 33mm (imagen 4) de diámetro con cambios inflamatorios en su periferia (estriación grasa) sin adenomegalias. Debido al diámetro del apéndice en esta ocasión se realizo una apendicectomía laparoscópica pero con la sospecha de un tumor del apéndice, en efecto patología confirmo un cistadenoma mucinoso del apéndice con cambios inflamatorios agudos.



Justificación

Presento este estudio para analizar la justificación para realizar tomografías en este tipo de casos, ver si se disminuye la incidencia de apendicectomías negativas; También analizar la sensibilidad y especificidad de la tomografía para diagnostico de apendicitis aguda en el Centro Médico ABC

Objetivo

Este estudio tiene como consecuencia dos objetivos:

- Conocer la sensibilidad, especificidad, valor predictivo negativo, valor predictivo positivo de la tomografía para el diagnóstico de apendicitis aguda
- Conocer la influencia de esta practica sobre la incidencia de apendicectomías negativas
- Comparar el diagnóstico clínico (a través de la Escala de Alvarado) con el diagnostico por tomografía en apendicitis aguda

Hipótesis

Se supone que la sensibilidad, especificidad, valor predictivo positivo y negativo de la tomografía para el Centro Médico ABC es similar a la reportada en la literatura mundial. De ser esto cierto se espera que el uso de la tomografía disminuya el porcentaje de apendicectomías negativas

La hipótesis nula es que la tomografía no tenga la certeza diagnostica que esperamos demostrando que en este caso aun debemos de depender por completo de la clínica y dejar la tomografía con un papel secundario.

Diseño

Este es un estudio retrospectivo en el cual se revisaron los expedientes de todos los pacientes a los que se les realizo apendicectomía en el periodo de un año. Se recabaron los datos demográficos de los pacientes así como su número de expediente y otros datos de identificación, junto con las características clínicas de su cuadro, los resultados de laboratorio, obteniendo la calificación de la escala de Alvarado para cada uno de ellos.

Se recabo si se les realizo o no tomografía y de los que si se realizo tomografía se recabaron datos como el grosor del apéndice, si presentaba o no fecalito, si tenia reforzamiento de la pared con contraste intravenoso, si presentaba estriación de la grasa circundante y si presentaba adenomegalias relacionadas al proceso inflamatorio apendicular de este modo determinando si la tomografía sugería el diagnóstico de apendicitis aguda. En todos los casos se contó con los reportes de patología utilizando estos como estándar de oro para el diagnóstico

Material y métodos

Se recabaron y revisaron los expedientes de todos los pacientes a los que se les realizo apendicectomía en un periodo comprendido entre el primero de enero del 2012 hasta el 31 de diciembre del mismo año encontrando un total de 357 expedientes.

Se excluyeron todos los expedientes de aquellos pacientes a los que la apendicectomía se realizo asociada a otro procedimiento (por ejemplo rutinas de ovario) o alguna otra patología (Por ejemplo pacientes en los que se opero por perforación de víscera hueca y el cirujano decidió retirar el apéndice sabiendo que estaba sano) y se descartaron todos los expedientes incompletos en los que no pudimos recabar toda la información que necesitábamos con lo que quedamos con un total de 261 expedientes de pacientes.

A cada expediente se le recabo el numero de expediente, el numero de episodio, el nombre del paciente, la edad, el sexo, los signos y síntomas clínicos que presento a su ingreso a urgencias (dolor migrante, anorexia, nausea, vomito, dolor a la palpación de FID, rebote) los resultados de laboratorio (Leucocitos, neutrófilos, segmentados y bandas), reporte de patología, si tenían tomografía su reporte y si está indico sospecha de apendicitis aguda, lo cual se baso en diámetro del apéndice, presencia de apendicolito, estriación de la grasa, reforzamiento del contraste IV de la pared del apéndice y adenomegalias locales.

Con los datos clínicos obtenidos de cada paciente se aplico la calificación de la escala de Alvarado y se evalúo la sensibilidad y especificidad, así como el valor predictivo positivo, valor predictivo negativo, el porcentaje de apéndices blancos y el porcentaje de apéndices

que hubieran pasado desapercibidos de la escala de Alvarado como prueba diagnostica por si misma; Lo mismo para la tomografía como prueba diagnostica por si misma.

Los datos estadísticos, la sensibilidad, especificidad, valor predictivo positivo y valor predictivo negativo así como los porcentajes de apendicectomías negativas y apendicitis que pasarían desapercibidas para cada prueba diagnostica se obtuvieron apoyados en el programa "SPSS-Statistics"

Este estudio no tiene ningún conflicto ético ya que al ser retrospectivo no implico ninguna modificación en el tratamiento de los pacientes y no le genero ningún riesgo a los pacientes.

Resultados

Se encontraron 357 expedientes de pacientes a los que se les realizo apendicectomía, de estos se eliminaron aquellos a los cuales se les realizo la apendicectomía como parte de otro procedimiento o padecimiento (por ejemplo pacientes con hemicolectomias derechas por cáncer o apendicectomía como parte de una rutina de ovario, etc.); también se eliminaron aquellos expedientes incompletos que no permitían la adecuada recabación de los datos que buscamos (aquellos que no tenían biometría hemática prequirúrgica en el expediente físico ó electrónico, aquellos sin mención de los síntomas y signos del paciente a su ingreso ó aquellos en los que no se encontró el reporte de patología).

Después de esta depuración inicial tuvimos 261 expedientes útiles, De los 261 expedientes estudiados fueron 136 hombres y 125 mujeres, con edades entre los 5 y 86 años de edad, 58 fueron menores de 18 años, 185 entre los 18 y 60 años de edad y 18 mayores de 60 años, con un promedio de 30 años y una media de 27años. En todos se conto con reporte de patología, encontramos que se realizaron 21 apéndices blancas lo cual corresponde al 8% un porcentaje menor al aceptado por la literatura mundial (10-15%). La calificación por escala de Alvarado se obtuvo en los 261 pacientes.

Se le realizo tomografía como apoyo diagnóstico a 162 de los 261 pacientes (62%)

Se encontró que la sensibilidad (S) de la tomografía por si misma para el diagnóstico de apendicitis fue de 88.3% con una especificidad (E) del 50%, con un valor predictivo positivo (VPP) del 97% y un valor predictivo negativo del 19%.

Esto quiere decir que es un buen estudio para detectar certeramente apendicitis aguda, además que si la tomografía dice que tienes apendicitis aguda es 97% probable que así sea, sin embargo por su baja especificidad y muy bajo valor predictivo negativo no podemos asegurar que si la tomografía da un resultado negativo, en realidad el paciente no tenga apendicitis aguda.

Se encontró que la clínica evaluada por la escala de Alvarado tomando como punto de corte todos aquellos pacientes que sumaran 7 o más puntos tenia por si misma una sensibilidad del 51%, una especificidad del 85%, un valor predictivo positivo del 97% y un valor predictivo negativo del 12%, tomando en cuenta solo la clínica pero que sumara 9 o mas puntos en la escala de Alvarado encontramos una sensibilidad del 14%, con una especificidad del 100% un valor predictivo positivo del 100% y un valor predictivo negativo del 8.8%.

Si tomáramos en cuenta como prueba diagnostica la tomografía, pero no por si misma si no en pacientes con dolor en fosa iliaca derecha como único signo clínico, es decir, realizarle la tomografía a los pacientes con dolor en fosa iliaca derecha, tendría una sensibilidad del 90% con una especificidad del 42% un valor predictivo positivo del 96% y un valor predictivo negativo del 21.4%.

	TAC	Alvarado ≥7	Alvarado≥9	DFID/TAC
Sensibilidad	88.0%	51.0%	14.0%	90.0%
Especificidad	50.0%	85.0%	100.0%	42.0%
VPP	97.0%	97.0%	100.0%	96.0%
VPN	19.0%	12.0%	8.8%	21.4%

VPP: Valor predictivo positivo, VPN: valor predictivo negativo, TAC: tomografía, DFID/TAC: dolor en fosa iliaca derecha y tomografía

Si usáramos solo la tomografía como estudio diagnóstico para apendicitis tendríamos solo un 2.8% de apéndices blancas pero 11% de las apendicitis agudas pasarían desapercibidas aumentando el riesgo de perforación, si tomáramos 7 o más pts en la escala de Alvarado tendríamos 2.3% de apéndices blancas pero hasta 48% de apendicitis agudas desapercibidas. En el caso de los pacientes con dolor en fosa iliaca derecha y tomografía tendríamos 3.5% de apéndices blancas y 9% de apendicitis que pasaran desapercibidas.

Porcentaje de apéndices blancos utilizando	
TAC	2.8%
A≥7	2.3%
A≥9	0.0%
DFID/TAC	3.5%

Apendicitis que pasarían desapercibida	
TAC	11.0%
A≥7	48.0%
A≥9	85.0%
DFID/TAC	9.2%

Otros datos que encontramos fuera de la intención de análisis inicial de este estudio es que los únicos signos clínicos reportados en la exploración son Mc Burney, Rovsing, Von Blumberg, Talo percusión, Psoas y Obturador, solo se reportaron en 77% de los expedientes.

Discusión

Aun cuando la tomografía en la literatura mundial tiene una sensibilidad y especificidad muy alta (96 y 95%), en este hospital no supera el 90% y 51% respectivamente, esto obliga a pensar que no podamos dejar aun lado la clínica, aun mas cuando se observa que la especificidad de la escala de Alvarado con mas de 7pts es del 85%

Tomando en cuenta que la escala de Alvarado por si misma con mas de 7 pts y la tomografía por si misma tienen un valor predictivo positivo del 97 y 97% y un valor predictivo negativo del 12 y 19%, podemos afirmar que las dos son un muy buen instrumento para confirmar el diagnóstico pero no para descartarlo y tomando en cuenta que cada vez más, los médicos jóvenes aplican menos el examen clínico en su toma de decisiones (o por lo menos la reportan menos), se considera que seria adecuado realizar tomografía a todos los pacientes con sospecha de apendicitis y en aquellos que fuera negativa mantenerlos en vigilancia; Además de entrenar mejor en la clínica a nuestros estudiantes de medicina y residentes.

Si a todos los pacientes que les sospechamos apendicitis aguda les realizáramos tomografía tendríamos un porcentaje de apéndices blancos muy bajo cercano al 3%, ya que encontramos que a los pacientes que se les realizo tomografía tuvieron solo 2.8% y a diferencia de la clínica solo pasarían desapercibidas 9.2-11% en lugar del 48% de las que pasarían desapercibidas con 7 o mas puntos de la escala de Alvarado, ya que observamos que de todos los pacientes que tuvieron menos de 7 puntos de la escala de Alvarado 48% tuvieron apendicitis aguda confirmada por patología.

Se encontró como hallazgo sin que esto estuviese planteado como parte del estudio que los cirujanos mayores de 50 años de edad solo pidieron tomografía en 42% de los casos con 8.7% de apéndices blancos mientras que los menores de 50 años pidieron TAC en 84% de los casos con 5.4% de apéndices blancos, la diferencia de porcentajes de apéndices blancos entre estos dos grupos no es estadísticamente significativa con una p=0.2

Los cirujanos mayores a 50 años de edad solicitaron menos estudios topográficos y tienen un porcentaje de apéndices blancos aceptable. La experiencia les ha llevado a se selectivos en cuando solicitar una tomografía y su percepción de la clínica es superior, Si quisiera estandarizar el proceso de diagnóstico de apendicitis aguda seria recomendable y eficiente realizar una tomografía siempre que se tenga duda en el diagnostico de apendicitis aguda, En especial cuando no se tienen tantos años de experiencia de respaldo.

Proponemos para esto lo siguiente, en caso de sospecha de apendicitis aguda:

1. Se realice una exploración clínica adecuada y estudios de laboratorio de calidad
2. En todos los casos se califique la escala de Alvarado
3. En los que se tenga duda diagnostica o menos de 7pts en la escala de Alvarado, se realice tomografía
    a. En los que resulte positiva, realizar apendicectomía.
    b. En los que resulte negativa, mantener al paciente en vigilancia.

Conclusión

El cuadro clínico, la exploración adecuada y la ayuda de laboratorio tiene prioridad en el diagnostico de apendicitis aguda, enseñar a nuestros estudiantes y residentes a realizar una buena evaluación clínica es indispensable.

Es recomendable para esta institución que en todo paciente que se sospeche de apendicitis aguda, con una escala de Alvarado menor a 7pts se realice tomografía, en aquellos que sea positiva que se les realice apendicectomía y en aquellos que sea negativa se mantengan en vigilancia.

Probablemente con este planteamiento se reducirían las apendicectomías negativas a menos del 3%, con la vigilancia posterior se reduce el riesgo de apendicitis que pasen desapercibidas, estos factores reducirían el tiempo de estancia en la sala de urgencias y se proporcionaría un tratamiento quirúrgico oportuno, reduciendo los costos. Aunque para valorar lo propuesto en esta modificación a la práctica habitual se tendrían que realizar estudios con mayores factores de análisis y numero de pacientes

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THE INDICATIONS FOR EARLY LAPAROTOMY IN APPENDICITIS.

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THE title of this paper is one which a very few years ago, not more than four, would have excited the surprise and even the condemnation of many surgical and medical practitioners. The very fatal character of the disease formerly known as perforative inflammation of the vermiform appendix was thoroughly appreciated much longer ago than that, but this form of the disease was looked upon as a disease *sui generis*, as beginning with a distinct intent, and as terminating fatally. And it was not until 1686 that the cloudiness surrounding the peri-cœcal inflammations was largely dispelled by the remarkably clear and able paper read before the Association of American Physicians by Reginald Fitz of Boston. Since that time much attention has been paid to this subject both by surgeons and physicians, and I know of no surgical topic to which more frequent contributions have been made by surgeons from all parts of this country than that now recognized as inflammation of the vermiform appendix, or appendicitis. The pathology of the disease has been closely studied, and a vast amount of information in this field has been gathered together, the most valuable part of which has been only recently contributed by physicians and surgeons, who, embracing the opportunity afforded by early operations, have been able to study the pathological processes from their inception. We have learned to discard the terms typhlitis, perityphlitis, paratyphlitis, extra-peritoneal abscess of the right iliac fossa

and the like, except when we wish through the use of these terms to indicate a secondary or late process, but one originating almost without exception in an inflammation of the vermiform appendix. We have learned that there is no such disease as idiopathic peritonitis, and that, excluding the special causes of peritonitis, which exist in the female, the cause of the vast majority of cases of peritonitis is an inflammatory process originating in the appendix. We have learned that appendicitis is a disease of frequent occurrence, that it is responsible annually for a large number of deaths, and that none of the older methods of treatment afford the practitioner any actual control of the disease, although medical treatment, rest, and intelligent nursing are doubtless of great value in limiting the extent and shortening the duration of the milder attacks. But, lest I give a wrong impression, I must distinctly state here, that there are many cases of appendicitis of a mild character which rapidly convalesce under no other treatment than that just referred to, and that not a few severe cases eventually recover without other active aid. Nevertheless the mortality under conservative treatment remains large, much larger, I am firmly convinced, than any statistics can prove, for many fatal cases occur whose true origin has never been suspected, and some cases too, which pass through one attack successfully, and are so noted, come finally to a fatal attack at a distant period. I may mention as an illustration of the difficulty of collecting complete statistics of the mortality of the disease under discussion the following incident: Not long ago I met in consultation over a severe case of appendicitis, one with very unfavorable signs, a gentleman much older than myself and of very large experience. I advised an operation as urgently called for, and he entirely opposed the proposition. In explanation he added that although he had in his long and active practice "met with many such cases" *he had never known one to terminate fatally*. In a discussion recently taking place at a meeting of a Surgical Socity, one member referring to appendicitis, said, that although he had seen such cases for years, none had terminated in abscess or death and none had recurred. The statistics given by close observers justify one in concluding from such remarks as those just quoted, that

many fatal cases are certainly not recognized at all. Fitz, in his remarks made before the Association of American Physicians last year, gives the mortality as 26%. L. A. Stimson, in a paper read before the Surgical Society of New York, on October 8, of last year, gives the mortality as 25%, and these percentages are so trustworthy and are made up from such a large number of personal cases that they may fairly be used as a basis for discussion. It is not my purpose, however, to endeavor carefully to estimate the mortality from appendicitis, and I have referred to the above statistics only that I might impress the fact that in discussing the treatment of appendicitis we are discussing the treatment of a disease, which when all cases are treated conservatively, kills a great many people. While the diagnosis of an inflammation of the appendix is usually not difficult when a careful examination is made, and is often very easy, yet, I know of no localized disease which is capable of presenting such a variety of pathological processes. The real difficulty lies in estimating at an early period the probable behavior of each individual case, and yet, on such estimate on the part of the attendants will depend the line of treatment.

I must, therefore, dwell on the diagnosis of the disease and endeavor to weigh the value of each symptom. Abdominal pain of greater or less severity is usually the first sign of appendicitis, but valuable time is often lost by reason of the misleading character and position of the pain. It is, at first, often referred by the patient to the whole abdomen, frequently to the epigastrium alone, sometimes to the umbilical region, and only in about half the cases does it begin at once in the right iliac fossa. But after a few hours or a day, it becomes more and more evident that the chief seat of pain is in the iliac fossa and then the diagnosis is generally made. The *slight* character of the pain is sometimes seriously misleading, so that a diagnosis of mild enteritis, constipation or colic is sufficient to satisfy both physician and patient. In some cases a prodromal stage of abdominal discomfort lasting a week, or even longer, precedes real pain. I have found the *exact* locality where the greatest sensitiveness to pressure exists to be a valuable means of diagnosis, so that in every case of abdominal

pain, not otherwise satisfactorily explained, I make a careful search for it. In the first hours of an attack of appendicitis it is not enough to compress with the whole hand the region of the iliac fossa. Such pressure will often elicit no more complaint from the patient than pressure of a similar kind made at other parts of the abdomen. But if firm pressure is made with the finger-tip, and especially if the patient be made to cough while such pressure is being exerted, it is invariably easy to determine that the most sensitive point is a definite one in most cases. This point is very accurately in the adult from $1^1/_2$ to 2 inches inside of the right anterior superior spinous process of the ilium on a line drawn to the umbilicus. In children it is, in proportion to their size, so much less distant from the spinous process. Occasionally this most sensitive spot will be found a half inch or so nearer the pubes, and sometimes this sensitive area will be larger than usual, but from the first hours of the disease even up to the end of several days, this sign may be clearly made out in every case. No other acute disease presents this feature. The accuracy of this sign I have demonstrated in every case operated upon by me since I first made the observation. The point described corresponds very accurately in the living subject, to the base of the appendix, and for this reason the sign is clearly defined whether the appendix is long or short, or points up or down. Of course, in late stages of the disease this sign does not usually exist. My friend, Dr. Weir,[1] commenting upon this observation of mine as to the exact spot of extremest sensitiveness on finger-tip pressure, does not agree with me as to its value, and says: "Furthermore, I have myself found on examination of 18 healthy persons by the above test of McBurney, that in 4 of them decided evidence of tenderness existed without other history of appendical attacks." When we remember that in 300 autopsies made at random by Tofft, 36%, over one-third, revealed evidence of disease of the appendix, Dr. Weir's examination would seem to be a singular confirmation of the delicacy of the test. Four out of the 18 is below the average. With the initial pain some patients have a chill, and vomiting may be

[1]Philadelphia Med. News, March 1, 1890.

severe. In other cases both or either of these symptoms may be absent. Fever to some extent is soon present in all cases except the mildest, but it varies greatly in degree, some cases having a temperature on the first day of less than 100°, others rapidly reaching a temperature of 103.5°. Rigidity of the muscles on the right side is a very constant sign and one of value.

The extent of tympanites varies greatly and its degree does not measure the severity of the disease at the onset. It may be very decided during the first day in some moderate cases and even entirely absent in some of sudden perforation. This sign must depend for its existence largely on the state of the patient's bowels, the ease with which the intestine in a given individual is brought to a state of paresis, and on other causes. As a rule, rapidly increasing distension is a positively unfavorable sign. Tumor may or may not be appreciable during the first two days. Sometimes the enlarged inflamed appendix itself can be distinctly felt at a very early period. As a rule, with few exceptions, tumor can be detected by the end of the second or third day. In very mild cases it is absent. The tumor consists of the appendix alone, or of the appendix surrounded by thickened omentum or inflamed œdematous intestine. Within the tumor pus is frequently found but it is often absent. The percussion note is not necessarily dull. Tympanitic percussion may be noted, due to the fact that a portion of intestine full of gas lies over the tumor. Generally the patient complains if the right thigh is over extended, and he will object if he is asked to cough. Rectal examination at the onset is of no value. The pulse deserves careful examination. By its variation from the normal condition it often indicates the severity and the increase of the disease, as it always expresses the amount of constitutional disturbance.

But few signs, then are constantly present within the first 24 hours. The history of sudden onset, the point of greatest sensitiveness to pressure exactly localized over the situation of the base of the appendix, fever as shown by the thermometer and the pulse, and rigidity of the right abdominal muscles, are the most constant and valuable signs in making an early diagnosis. In very mild cases no sign may be present excepting that of sensitiveness at the point described.

The making of an early diagnosis is of the greatest importance in reference to treatment. When no diagnosis is made opiates are usually freely given to subdue pain, more or less intestinal paresis and distension result, and pain being obliterated the arrival at a correct diagnosis is postponed from day to day. I have been asked to see a number of cases treated in this manner, and in most of them the diagnosis had been made with difficulty. Of the use of the hypodermic needle as an aid to diagnosis I can only say that I think it should never be used. If it discovers pus it may still have done harm in finding its way to or from the pus, and if it does not discover pus, the negative evidence thus procured is of no value. What is the value of pain as a measure of the gravity of an individual case? If great intensity of pain always existed in grave cases or if great intensity of pain always marked a serious and advanced stage in the pathological process, we should have no difficulty in separating our cases into two classes, one consisting of the mild ones and another of the severe ones.

In illustration let me quote briefly two cases: One, a healthy young man, had been attended for two days by two extremely competent physicians. His pain had been so slight, his fever only 100°, and his other symptoms so mild, that no diagnosis had been reached. On the third day, without special aggravation of any symptom, he looked more ill and felt so. Nevertheless, when I visited him with the late Dr. Sands he had become already septic. Laparotomy was almost immediately done. The appendix was found much inflamed and partly gangrenous. It was perforated by a large concretion. No adhesions of the slightest kind existed, and the whole pelvis was full of foul pus. Another, also a healthy young man, had such severe pain that during the first twenty-four hours that his physicians gave him one and one-half grains of morphine, without securing complete relief. When I did a laparotomy on this patient I found an appendix with only moderate signs of inflammation on its interior, and absolutely no peritonitis. This appendix contained six fæcal concretions.

But subjective pain as described by the patient is one thing, and sensitiveness to pressure when a careful examination is made is another. The latter is the sign that is of value. Dur-

ing the first twelve hours many cases, destined to develop the disease to very different degrees, will behave very much alike. Some will continue to go about with little complaint, others will lie still because motion causes pain, and they are fairly comfortable when at rest. Others will have very great pain, with nausea, vomiting and complete disability from the first hour on. Some will have during this period a quite ordinary pulse of 80 to 90, and a normal or very slightly elevated temperature, while others, beginning with a chill, will have a full bounding pulse, a flushed face, and a temperature of 102°, or more, from the onset. Every one of these cases deserves the most careful attention. Why? Because every one of them has, so far as our present knowledge goes, the beginning of an inflammatory process within the peritoneal cavity, the full development of which not one of us can forecast at this stage. Within the second or third twelve hours the signs may become much more clear. For treatment these different cases should all be kept absolutely at rest. Vomiting, especially, should be controlled as completely as possible—if necessary, by total disuse of the stomach. Anodynes, when really necessary to procure immobility or a moderate amount of comfort, are indicated. Vomiting ceases soon, and the stomach can then bear light nourishment. Laxatives should be carefully avoided, and enemas as well, that all peristaltic action may be discouraged. As a local application over the cæcum and appendix, cold is by far the best. The India rubber cold coil is the best apparatus. Under this treatment, cases that have begun with very mild symptoms will usually, at the end of twenty-four hours, either become milder or cease to advance and one will be encouraged to continue the same plan, still being carefully on the lookout for the development of tumor containing pus, which may quietly form, although other signs are favorable. The more marked cases, those with fever of 101° or 102°, with decided sensitiveness to finger-tip pressure, and with a more rapid pulse, indicating more constitutional disturbance, may come to a standstill, or may show increased signs of progressing disease; and the cases that began with high fever, very great pain and frequent vomiting, will usually at the end of twenty-four hours begin to show abdominal dis-

tension, increasing distress, and many signs common to serious illness.

A class of cases which I have as yet purposely avoided describing is that generally described under the head of Perforative Inflammation of the Appendix.

I think a common misapprehension exists as to this class. When perforation of the appendix takes place suddenly at the very beginning, pain is usually for a while intense. Symptoms of shock more or less clearly defined exist, and these are rapidly followed by chill or fever, or both, by extended pain, vomiting and tympanites. Septic peritonitis is beginning, and the patient is often treated for "sudden peritonitis." But perforation of the appendix by concretion, foreign body or retained pus, may be quite late in its occurrence. If, before its occurrence, safe adhesions have formed about the appendix, the perforation will take place without special sign, and usually an abscess is formed. On the other hand, perforation may not occur at all and yet pus be rapidly formed. If limiting adhesions do not exist, or if the adhesions are incomplete or feeble, pus may flow over into the pelvis, and produce precisely the same sudden aggravation of symptoms, or even worse, as when the appendix is perforated at the beginning of the attack. On Friday, October 10, last, a boy, æt. 12, was seized with abdominal pains at noon. He went home from school, and was visited by Dr. A. M. Hurlbut, of Stamford, Conn., a most careful observer. The boy had slight pain only, with no fever, he was tender on pressure over the appendix, and the diagnosis of appendicitis was made by Dr. Hurlbut. After a quite comfortable night, the temperature was below 100° in the morning of the 11th, and remained at the same point that evening. The boy had been kept in bed and carefully watched, Dr. Hurlbut intending to send for me if signs of progressive disease appeared. At one o'clock on Sunday morning, the 12th, the boy woke with intense pain and vomiting, and was seen within an hour by Dr. Hurlbut, who found him pale, almost pulseless, very tender all over the epigastrium, and with a temperature by the mouth of only 98°. I reached Stamford by the first train, and as it was Sunday the first train was an afternoon one. At 3 P.M. the boy's tempera-

ture was 102.5°, and I did laparotomy. When the peritoneum was cut turbid serum in quantity poured out of the incision. The appendix was partly gangrenous, perforated by a fæcal concretion, and surrounded by an imperfect collapsed abscess wall. In the pelvis was more than a pint of purulent liquid, and intense septic peritonitis existed all over the lower half of the abdomen. It is certain that in this case the sudden pain and collapse at the thirty-seventh hour were caused by the rupture and overflow into the pelvis of a feebly protected abscess. I have quoted this case to show that, while perforative inflammation of the appendix is often spoken of as a disease beginning with marked signs of perforation and only to be treated with any hope of success by immediate operation, it may occur, and it often does so occur, as a somewhat later step in an attack commencing like a mild one. The rupture of an abscess into the peritoneal cavity at any period in the course of the appendicitis, causes the same symptoms and usually the same fatal result that the sudden early perforation of the appendix causes.

I have referred to the period of twenty-four hours as one at the end of which the character of an attack should be closely studied and a careful estimate of the probable behavior of the case should, if possible, be made. The character of some cases will be decided even before this time by the extreme severity of the onset. In these it will be evident almost from the first that perforation has already occurred, or that a considerable peritonitis has already begun. In the mildest cases at the end of twenty-four hours the symptoms will be diminishing slightly or will be at a standstill and the patient will clearly not be much ill. The more marked cases at the end of the same period will be a little worse. The tenderness on pressure will be more clearly defined, the temperature as high as, or higher than, it was a few hours before, the pulse will show increasing constitutional disturbance and a moderate tympanites may begin to be evident. And after this period the signs either of continued improvement or of increased disease will be constantly more clearly defined. Tumor may begin to be appreciable, tympanites will increase, and more especially will the examination with the tip of one finger re-

veal exquisite sensitiveness at the base of the appendix. Even among these cases of increasing severity not a few will, after a few days, begin to improve, the symptoms abate, even a considerable tumor gradually or quite suddenly disappear and the patient will have finished with one attack. Or, while the patient becomes more comfortable in general, the tumor increases in size, becomes very clearly marked, and an abscess rapidly develops within the peritoneal cavity it is true, but well limited by strong adhesions. Out of a number of cases, all beginning in a somewhat similar manner, at the end of a week some will have died from general peritonitis, supposing them all to have been treated conservatively, others will be well or on the road to recovery, and others again will be waiting for the surgeon to open the abscess, running the risk from hour to hour of serious accident. As Prof. Bridge says:[2] "The abscess, wherever it is, and however well it may appear to be surrounded by protecting plastic deposits, is a constant menace to life, as evidenced abundantly by its spontaneous opening into the abdominal cavity, the venous canals, the bladder and chest cavity, as well as externally, and into the intestinal canal."

If one may judge from the description of appendicitis which I have given, and this description is not so very different from that given by numerous writers, we have to deal with a disease presenting itself with a very unusual variety and irregularity of symptoms, not difficult to diagnosticate, however, if careful examination is made early, but the course of which it is practically impossible in almost all cases to prognosticate during the first twelve hours. Our difficulties are again increased not only by the large variety of pathological lesions belonging to the disease, but also by the very great difference in the length of time occupied by the disease in producing a complete lesion, for instance, perforation of the appendix in one case, from that occupied in producing the same lesion in another. In one case the completion of the process of perforation may occur within a few hours from the onset, in another perforation may not be complete up to the sixth day. All who have

[2]Transactions American Physicians, 1890, p. 31.

had practical experience with early operations for appendicitis will agree that we cannot in all cases at an early period of the disease, within the first two days, decide from signs and symptoms whether protecting adhesions are forming or have formed or not. To be positive in regard to many points of the utmost importance we must wait. If we wait long enough, say to the seventh, eighth or ninth day, many of these difficult questions will be solved, for one after another of our patients will have died, and one after another of our questions will have been answered. On the seventh, eighth or ninth day we shall be able to muster together a more or less dilapidated majority of our cases, who will have successfully passed through many dangers, and not a few of whom now await the knife to give them the first opportunity to start on the road to recovery, a road by no means devoid of risk. According to Fitz,[3] of 176 cases of perforative inflammation of the appendix, 60 died during the first five days, 46 during the first four days, and 28 during the first three days. On the second day alone 8 cases died. But this statement only represents the day of death.

In reference to treatment it is far more important for us to know *when that pathological process begins* which directly causes the deaths on the third, fourth and fifth days. This process is usually sepsis and it is safe to say that in very large majority of the cases dying within the first five days, the fatal sepsis, hopeless for medicine, and nearly hopeless for surgery, *begins before the end of the third day*. At what hour, if we expect to save almost all of our cases, the severe as well as the mild ones, must we decide how we will treat a given case? Naturally before the process has begun which will soon render the use of medicine a farce, and an operation little better than an autopsy. Should then all cases of appendicitis be operated upon on the *first* day so as to anticipate every danger? Certainly not. As our means of diagnosis are improved, and as the study in the dead house has been more carefully directed to the appendix, we have learned that the class of extremely mild cases of appendicitis is large. Within a year I have myself seen thir-

[3]Transactions of American Physicians, 1886, p. 126.

teen cases in which the diagnosis was clear and yet the attack so mild that no one would have thought of recommending an operation. Nevertheless, even in such cases, at the very commencement, during the first few hours of the attack, a decision cannot always be safely reached at the first visit. Each case must be carefully and frequently studied if we would avoid on the one hand the doing of unnecessary operations, and on the other hand, the discovery that our patient, who was comfortable in the evening, is on the following morning profoundly septic.

The earliest possible diagnosis and frequent examination of the patient may properly be demanded of every physician or surgeon who is called to attend a case of appendicitis. Clearly defined rules that will guide one safely in all instances in deciding when a case of appendicitis may be safely treated conservatively cannot be laid down. A general description, often applicable, is the best substitute that I can offer. The diagnosis having been made in a given case, the treatment already described as applicable to mild cases should be at once instituted; anodynes should be carefully avoided, or at least given so moderately as not to mask symptoms subsequently. If nausea disappears within twelve hours, if at the end of the same period tenderness on pressure has not increased, if the temperature remains normal, or has not risen to 100° in the mouth, if the pulse is not accelerated, or but very little, if the patient moves in bed with ease, one is justified in regarding such a case as probably a mild one destined soon to recover. If at the end of twelve hours more the same indications exist, or there is very little change, the chance of a favorable ending is still better. If, during the succeeding two days, no tumor has formed, the symptoms have all improved, or some have improved while others remain stationary, the case may be considered as practically safe, although complete rest should still be enjoined. A moderate enema may be safely given, and often with benefit. Within the week probably all symptoms of the disease, excepting perhaps a little tenderness on pressure, will have disappeared. In other cases one or several symptoms will be more marked. The temperature will from the beginning be higher, perhaps rapidly reach 102°, the pulse

will be quick and full and nausea considerable but these symptoms will not increase in severity and the general aspect of the patient will be so good at the end of 24 hours that conservative treatment is clearly indicated. In these latter cases a short interval of, say, twelve hours more, will usually develop signs of improvement, or of cessation of advance, or of advance of symptoms. If signs of improvement have appeared medical treatment will be continued. If symptoms have merely ceased to advance, the decision will be postponed to another visit to be made after a short interval, and the medical treatment will be meanwhile continued. But if the third alternative has arisen, if the symptoms have become more marked, then the question of immediate operation arises.

In all of these cases which, at the end of thirty-six hours from the beginning, show well-marked signs of increasing disease, the question of an operation should be deliberately and carefully discussed and in my opinion done. The operation to be discussed is the one of the removal by laparotomy of the diseased appendix, the exact condition of which is not known, but which may cause the death of the patient, either within a few hours, or within a few days, or perhaps at the end of a long period by recurrence of disease. These are the cases whose treatment deserves immediately the closest consideration. It is *not* best to wait for "strong evidence of perforation, abscess, or general peritonitis." It is *not* satisfactory to wait until the pulse becomes rapid and weak, and the respiration anxious. What are the signs of "impending perforation?" No one can name them. When we discover "spreading" peritonitis, peritonitis has already spread. If it has passed beyond the wall of an abscess then the abscess has already ruptured. If we wait for marked distension of the abdomen, we shall often find at operation a septic paresis of the gut, from which condition I have yet to see a single patient recover. Such indications as these are the very conditions we should endeavor to *anticipate*, if we wish to save almost all of our cases. By the end then of thirty-six hours, sometimes much earlier, the question of operation should be deliberately discussed by the physician in attendance and the surgeon who would be called on to operate, if operation were deemed necessary. Surely

the latter can aid in interpreting the indications for or against operation before the time when the former shall have exhausted his medical resources. As a rule, with but rare exceptions, the indications of advancing disease can be clearly made out by the end of thirty-six hours, provided that the diagnosis has been made early, and that several careful examinations have been made subsequently. Advancing disease with clear signs at this period should be operated upon.

To be sure, in following such a rule, we shall sometimes operate upon and remove the appendix from a patient who could have recovered without operation and without abscess. This will not often happen. If it does, we shall have at least, at the same time, cut off the appendix, and the opportunity for a recurrence of disease, perhaps in a very intense form, and under very unfavorable conditions.

Cases which require operation at any earlier period than this are those of very sudden perforation, sometimes with, sometimes without, premonitory signs. In these cases the intensity of the pain, its very sudden onset, the shock, the marked constitutional disturbance, all point the way to immediate operation. In some of these, however, shock, even collapse, may be so great, that one is forced to delay, to stimulate the patient, and await at least a beginning reaction. With the late operations this paper does not deal. They will continue to be numerous, and through our efforts not to be too hasty with surgery, we shall lose some cases by death, and we shall also allow abscess to form which we will open on the sixth, seventh and eighth day.

Such presentation of this subject as I have made very properly requires supporting evidence. The patient inquires, the physician inquires, and the surgeon asks himself, which is the greater of the two evils, the disease or the remedy? Not a great many years ago only one answer would have been made to this question. The removal of the appendix in an acute state of inflammation would probably have failed to save in a larger number of cases than the disease would have killed. To-day this is not so. The operation is undoubtedly a serious one, but the results of operation have improved vastly, while the disease shows no signs of mitigation. Not a little miscon-

ception exists in regard to the dangers of the operation. As affecting the mortality record of surgical interference all of those cases may be thrown out where surgery has been resorted to to save a patient from a general suppurative peritonitis, from septic paresis of the intestine and multiple abscess in the peritoneal cavity, although even in such cases surgery has sometimes been successful. But we know that these cases are nearly always hopeless, although we often only discover this fact when the abdomen is opened. We should not forget that in the beginning of the disease we usually have to deal with a patient who was perfectly well up to the first sudden pain. No exhaustion, no general sepsis, no debility through long abstinence from food, prolonged vomiting, exist as obstacles to our best efforts. Furthermore, most of our patients are young, and the majority males. According to Fitz,[4] in 228 cases of appendicitis 173 were below the age of 31 and 207 below the age of 41.

An important and encouraging fact that has not been often referred to is that although the apparent danger of causing infection of non-affected peritoneum in the course of an operation for the removal of a diseased appendix is very great, yet in reality experience has shown this not to be the case. In a considerable number of these operations done at an early period, I have found pus present in considerable quantity. Non-infected portions of peritoneum must necessarily in the course of such an operation come in contact with sponges, instruments and fingers, and yet infection of the general cavity from such a source has not occurred in a single instance. But I should be doing surgery a gross wrong were I to give the impression that I considered operations for the removal of the appendix lightly. It is a serious operation, often a very difficult one, one requiring general surgical skill, good assistance, and every antiseptic precaution, and I do not recommend the operation to one who has never even seen it done, nor do I recommend it when the requirements such as I have referred to are not attainable.

A few years ago I felt that we greatly needed actual demon-

[4]Trans. Amer. Physicians, 1886, p. 14.

stration through the results of operation, that the operation could be done by different individuals under varying conditions and with something like uniform success. If such evidence could be accumulated then we could answer the question in regard to the remedy and the disease in favor of the remedy. Such evidence has come to us from various quarters, from Sands, from L. A. Stimson, Weir, Bull, Morton, Senn, Treves, Hartley, Mynter, Dalton, and from many others. And many of these successful operations have been done when the conditions were not of the best, when the cases had been long delayed, for one reason or another not the fault of the surgeon. But I have not been able to analyze and present in proper form the numerous cases referred to, and I must be content with making here my personal contribution to this interesting subject of early laparotomy in appendicitis. By early laparotomy I mean operation before the pathological process has reached a very advanced stage. This cannot be measured by time. In some the rapidity of the process is very marked, in others very slow. Some patients ask for attendance on the first day, and some not until the third or fourth day. I include in my list of cases *all* of the cases treated by early operation in my hospital and private practice before general septic peritonitis had begun, before pus had flowed freely down into the pelvis, or before complete septic paresis of the intestines had set in. These conditions are frequently fatal even with operation, and I am sorry to say that I have had to operate upon a number of such, and without success, although in some of these the operation was done at an early period as regards time, but at a too late one so far as the development of the disease and the surgical indications were concerned.

In studying this subject of *early* laparotomy for appendicitis we must not admit into our statistics operations done at a late period when a well protected abscess, such as can be properly treated by Parker's incision, has formed. From such an abscess of course the appendix may in some cases be extracted. Some such cases I have seen reported as examples of laparotomy for removal of the appendix. The appendix in such cases will generally be taken care of by the process of sup-

puration, as is shown by the usual recovery of patients whose abscesses have been opened and the appendix never seen.

An early operation is an operation done at a time when the removal of an actually diseased appendix is capable of putting an end at once to an active disease which has already become clearly defined and which threatens life.

Of this class of cases I now present to you the results obtained in twenty-four instances. The first of these was operated upon in May, 1888, and the last one week ago, January, 1891.

These include all the cases of this class that I have operated upon up to the present time.

The cases I present are 24 in number; 21 were males and 3 were females; all were under 36 years of age. In all excepting one case the conditions were such that life was seriously threatened. In one case the conditions were such that life did not seem to be threatened by the attack for which operation was done, but the appendix was actively diseased, and a recurrence, if no operation had been done, would have been highly probable. The appendix was completely removed in all cases but two. In one partial removal was deemed sufficient, and in another removal was deemed unwise.

Recovery has occurred in every case excepting one.

Two cases are still under treatment, but are now absolutely safe from accident.

Six cases were operated upon on the second day; 14 on the third day; 2 on the fourth day; and 2 at the end of one week.

CASE I.—E. M. P., male, æt. 19, patient of Dr. F. M. Otis. Great rigidity of right abdominal muscles. Exquisite sensitiveness at point two inches inside of right anterior spinous process of ilium on a line drawn to the umbilicus. At this point small tumor to be felt Pulse rapid and full, temperature, 101°; general appearance excellent. Operation on May 21, 1888, 49 hours from the commencement of attack. Appendix tensely distended with half ounce of foul brown pus. Appendix removed at its base. Recovery without incident of any kind.

CASE II.—John S., æt. 10. Roosevelt Hospital August 19, 1889. Earliest symptoms one week previously. At operation, temperature, 103.4°; pulse, 110; nausea considerable; tender tumor; no tympanitis; small tumor found, consisting of small intestines, enclosing appendix

and a few drachms of pus. No other adhesions or peritonitis. Removal easy. Recovery rapid and complete.

CASE III.—W. K., male, æt. 16. Roosevelt Hospital, July 26, 1889. Abdomen slightly distended and tympanitic; temperature, 102°; pulse, 110; small, very tender tumor. Operation at 49th hour. Appendix 6¼ inches long, œdematous and much inflamed and thickened. Minute foci of pus scattered through its substance. No concretion and no perforation. No protecting deposits of any kind. Unbroken recovery without incident.

CASE IV.—Annie O., æt. 18. Roosevelt Hospital, May 30, 1888. History of previous attack 6 years ago. Tympanites great; small tumor to be felt; temperature, 100.4°; pulse, 100; respiration, 36. Operation on third day. Appendix found much enlarged, thickened and greatly discolored; a small cavity beneath the end of the appendix contained small quantity (less than one ounce) of pus. The appendix was perforated at its middle by a large fæcal concretion. Unbroken recovery.

CASE V.—Charles E. A., æt. 25. Roosevelt Hospital, September 2, 1889. Previous attack five months earlier. Operation on third day. Severe abdominal pain, nausea, vomiting, muscular rigidity; temperature, 102°; marked adhesions and thickened peritoneum from former attack. Appendix found with difficulty and removed. It was much inflamed, thickened and hardened; no pus. Easy and complete recovery; small skin abscess.

CASE VI.—Miss E. C., æt. 25, patient of Dr. W. T. Alexander. Prodromal stage of vague discomfort for two weeks. Severe pain and first disability June 19, 1889. Great abdominal pain, nausea; pulse, 100; temperature, 101°; patient excessively tender at site of appendix, and looked very ill. Operation at 24th or 25th hour; scarcely the slightest trace of adhesion; appendix completely gangrenous, and as large as one's middle finger. It was not perforated, but contained two large fæcal concretions; reddened small intestine lay above and below; two days of nausea and tympanites; after that unbroken recovery. This operation evidently just succeeded in preventing sepsis.

CASE VII.—Edgar C., æt. 21. Roosevelt Hospital, January 15, 1889. Initial chill and great pain; temperature, 101.6°; pulse and respiration about normal; right abdominal muscles rigid; very acute tenderness at usual point; no tumor. Operation at 48th hour. Appendix doubled on itself, much thickened and distorted, and containing a black semi-fluid material. It was not perforated; the whole wall of appendix gangrenous at one point, as far as the peritoneal coat. Unbroken and complete recovery.

CASE VIII.—C. G. McK., æt. 23. First attack two years ago; second attack six months ago; patient haggard and looked ill; an ill-defined tumor existed, and the abdomen was markedly distended. Operation delayed, contrary to advice, twelve hours. Operation October 19, 1889, about 52nd hour. Owing to the distended gut, the search for the appendix was extremely difficult. It was found flat, wide, hard and very firmly bound down in every direction by old adhesions from former attacks. About a drachm of foul pus was found beneath the centre of the appendix. The appendix could be only partially removed, owing to the dense adhesions. No symptoms were relieved. The temperature increased, tympanites became extreme, vomiting set in, and the patient died at the end of four days. My later experience convinces me that this patient died of sepsis, and that the tympanites was due to septic paresis of the intestine, a condition which had begun some time before the operation. Had an operation been done at the first attack probably no such difficulties as I encountered would have been met with.

CASE IX.—T. R. D., male, æt. 22. Roosevelt Hospital, July 4, 1890. Very severe abdominal pain before admission, also occasional vomiting. On admission, temperature, 99.6°; pulse, 102; severe pain in right iliac fossa; extreme tenderness at typical situation. Operation at about middle of third day. Some slight adhesions between intestinal folds. The appendix is found coiled on itself, very deeply placed, and containing several fæcal concretions. It was perforated in two places at its base, and beneath this portion was a small abscess. The appendix was ligated and totally removed. Recovery unbroken and complete.

CASE X.—Edgar C. B., æt. 21. Roosevelt Hospital, January 15, 1889. Severe general abdominal pain, followed by chill. Temperature, 101.6°; pulse and respiration good; general appearance excellent; characteristic extreme tenderness on pressure on base of appendix. Operation at 50th hour. Appendix found behind and inside of cæcum, and doubled on itself. Its removal was difficult. The mucous membrane was gangrenous, and at one point the gangrene involved the whole structure of the organ to the peritoneum. No concretion. Recovery unbroken and complete.

CASE XI.—T. H., male, æt. 23, patient of Dr. Chas. Hunter. Extreme and continued abdominal pain; temperature, 99°; pulse, good; points of extreme tenderness characteristic; considerable distension. Patient had received 1½ grains of morphine in 24 hours. Appendix found without difficulty. It was but little enlarged; peritoneum not in

the least inflamed; no adhesions. The appendix contained six small concretions. Recovery unbroken and complete.

CASE XII.—Charles H., æt. 26. Roosevelt Hospital, May 30, 1889. History of four attacks; severe abdominal pain, chill and vomiting; very tender tumor; temperature, 99.4°. Operation May 30, at end of one week from first symptoms. Appendix found firmly tied down by old adhesions. It was removed, and found to be soft, swollen and infiltrated throughout with small foci of pus. Recovery unbroken and complete.

CASE XIII.—John C., æt. 28. Roosevelt Hospital, March 22, 1890. Prodromal stage of nearly two weeks of slight pain and abdominal discomfort. On admission, great pain and tenderness on pressure at the usual characteristic point; small, deep, movable tumor; pulse, 90; temperature, 99°. Operation on third day. The appendix was with difficulty dissected away from adherent intestine. This operation opened a small abscess; only about two inches of appendix removed; some fever for two days after operation. Otherwise recovery unbroken, though slow.

CASE XIV.—S. T., male, æt. 15. Roosevelt Hospital, December 13, 1889. Pain and tenderness in right iliac fossa; extreme point of tenderness on pressure lower than usual; small tumor, no tympanites and no fever. Operation on fourth day. Appendix easily found and removed; no adhesions; much swollen and necrotic at distal extremity. Perforation nearly complete; no pus. Recovery unbroken and complete.

CASE XV.—Mary D., æt. 13. Roosevelt Hospital, December 23. Severe pain and nausea, with occasional remissions for three days; characteristic tenderness on pressure at usual point; small tumor to be felt. Operation on third day. No adhesions excepting at apex of appendix. This organ was much thickened and hard, and the mucous membrane swollen and pulpy. Recovery rapid and complete. This patient would probably have recovered under medical treatment.

CASE XVI.—C. E. A., male, æt. 25. Roosevelt Hospital, September 2, 1888. History of former attack six months ago; tells the story of a long-continued illness. Present attack began two days ago; severe abdominal pains, nausea. and high fever. On admission, tenderness all over right iliac fossa, and tense muscles; temperature, 102°. Operation on third day. A very difficult dissection, owing to old adhesions of an extensive character, ended in the discovery of the appendix at a deep point on the edge of the pelvis. It was short, thick and densely hard; no pus existed. Recovery a little troublesome, but complete in six weeks.

CASE XVII.—Wm. S., æt. 56. Roosevelt Hospital, November 19, 1889. Great abdominal pain; temperature not recorded; pulse quick and full; characteristic tenderness at usual point extreme; tympanites great; operation on the third day. Appendix found very deeply placed behind and inside of the caput coli. At its base was a small, very distinct abscess, containing about two drachms of pus. Intestine in and around the abscess free, and not adherent anywhere. The appendix was much broken down and imperfect; removal partial; recovery easy, but a long tedious fistula remained, which was not closed until June following, otherwise his health was perfect.

CASE XVIII.—E. P. L., male, æt. 21. Patient of Dr. Charles Scudder. Sudden onset of great abdominal pain; nausea very early; temperature 102°; pulse full and bounding; exquisite tenderness on pressure over base of appendix. Operation February 27, 1890, at about 48th hour. Appendix very large, gangrene throughout and soft and putrid; passed deeply down to and over edge of pelvis; no adhesions; marked inflations of intestines and the adjoining coils deeply reddened; no concretion; removal not difficult; unbroken recovery, rapid and complete. Only incident troublesome tympanites for three days.

CASE XIX.—Henry B., æt. 16. Patient of Drs. George S. Wheatlock and W. W. Hewlett. History of three previous attacks of severity; each occurred in a different country and on two occasions the temperature in attacks reached 104°. Fourth attack began at noon June 30, 1890. Very severe onset with pain and vomiting; high fever at once after chill. Operation at the 46th hour. Pulse 120; temperature 102.5°. Appendix short, hard and much altered; black at points, not perforated; respiration hurried.

Some old and very tough adhesions existed, but no recent ones. A wide open hollow by side of appendix held about two drachms of fœtid pus. If the boy had turned over in bed he would have poured this pus into the general cavity. Appendix completely removed, but with difficulty. Temperature continued high for two days. Constipation was troublesome, after that complete and easy recovery.

CASE XX.—E. S. H., male, æt. 35. Patient of Dr. F. Hewel. Sudden onset, but symptoms not intense; complete disability. Operation on the third day. Pulse moderate but feverish; temperature 101.5°; characteristic tenderness on pressure highly developed; small tumor; appendix much diseased, partly gangrenous and perforated very slightly by fæcal concretions, containing four bird shot. Very few binding adhesions; about one drachm of pus beside the appendix. Operation easy; recovery unbroken and complete.

CASE XXI.—W. W., male, æt. 23. Patient of Dr. B. C. McIntyre. History of serious attacks in the four years, each more severe than the last. Present attack began with epigastric pain, chill and vomiting, November 20, 1890. Operation at the end of the third day. Very ill look; small tumor; characteristic tenderness very marked. Temperature only 99 2°; small tumor very deep, behind and inside caput coli; fresh and old adhesions at this point only enclosing the appendix and the pus. The abscess was opened and the appendix recognized with the finger, but it was too much altered and bound down to justify removal. Recover easy and complete, excepting that a sinus is still open, otherwise health and comfort perfect.

CASE XXII.—A. B. O., male, æt. 35. Roosevelt Hospital, January 28, 1891. History of previous mild attack few months ago. Present attack began with sudden and severe pain in the right iliac fossa; this continued constantly. Operation middle of third day. Temperature 99.8°; pulse 80 and full; general look excellent; exquisite tenderness on pressure one-half inch below usual point; very small tumor to be felt. Appendix found doubled on itself, large, hard and much inflamed; it was quite concealed by recent plastic deposit; no pus; mucous membrane black and pulpy. Removal easy; convalescence perfect; still under treatment.

CASE XXIII.—C. O., male, æt 12. Roosevelt Hospital, January 1, 1891. Sudden onset; very great abdominal pain; vomiting; no chill. Operation middle of fourth day. Characteristic tenderness very marked at usual situation, but over a larger area. Small tumor. Temperature 101.6°. Appendix found in small cavity formed by small intestine alone and containing a few drops of pus. Appendix bent upon itself and perforated by fæcal concretion Partly gangrenous; removal difficut but complete. On third day lobar pneumonia; convalescence good, however, and wound to-day nearly healed.

CASE XXIV.—G. B, male, æt. 16. Patient of Dr. S. A Spalding. Sudden attack; high fever and pulse; local signs very marked; general appearance excellent. Operation at 40th hour. Appendix much diseased, contained two large concretions; it was not perforated. Recovery rapid and complete.

ORIGINAL CONTRIBUTION
appendicitis, acute, diagnosis of

A Practical Score for the Early Diagnosis of Acute Appendicitis

We conducted a retrospective study of 305 patients hospitalized with abdominal pain suggestive of acute appendicitis. Signs, symptoms, and laboratory findings were analyzed for specificity, sensitivity, predictive value, and joint probability. The total joint probability, the sum of a true-positive and a true-negative result, was chosen as a diagnostic weight indicative of the accuracy of the test. Eight predictive factors were found to be useful in making the diagnosis of acute appendicitis. Their importance, according to their diagnostic weight, was determined as follows: localized tenderness in the right lower quadrant, leukocytosis, migration of pain, shift to the left, temperature elevation, nausea-vomiting, anorexia-acetone, and direct rebound pain. Based on this weight, we devised a practical diagnostic score that may help in interpreting the confusing picture of acute appendicitis. [Alvarado A: A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med May 1986;15:557-564.]

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Received for publication April 5, 1985. Revision received September 11, 1985. Accepted for publication November 11, 1985.

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INTRODUCTION

Acute appendicitis is a common cause of abdominal pain in all ages. However, it is often a perplexing diagnostic problem during the early stages of the disease. In many cases, usually during the prodromal phase, its clinical manifestations may be vague and uncertain. Failure to make an early diagnosis is a primary reason for the persistent rate of morbidity and mortality.[1-3] Perforation rates range from 4%[4] to 45%,[5] and death rates range from 0.17%[6] to 7.5%.[7] Mortality in children less than 2 years old is surprisingly high (20%).[5]

The number of unnecessary laparotomies, particularly in women, may be as high as 45%.[1] The overall "negative" appendectomy rate ranges from 14%[2,8] to 75%.[9]

Our goal is to be able to reduce the negative appendectomy rate without increasing the risk of perforation. This might be accomplished by sharpening our diagnostic acumen, especially during the early stages of the disease, because most of the perforations occur outside the hospital.[2,3] A careful evaluation of each patient may reduce the number of "healthy" appendices removed.[4,6,8]

MATERIALS AND METHODS

The records of 305 patients who were hospitalized from January 1975 to December 1976 at Nazareth Hospital in Philadelphia, Pennsylvania, with abdominal pain (epigastric, periumbilical, diffuse, or in the right lower quadrant) suggestive of acute appendicitis were reviewed. Data, including age, sex, duration of pain, symptoms, physical signs, and such laboratory findings as white blood count (WBC), differential count, urinalysis, and pathology report, were tabulated from existing clinical records.

RESULTS

Of 305 patients hospitalized, 51 (17%) were kept for observation and treated nonoperatively. They were discharged from the hospital with the diagnosis of possible acute mesenteric adenitis (29 patients, 57%) or nonspecific gastroenteritis (22 patients, 43%).

Of the 305 patients, 254 (83%) had an appendectomy. Of these, 27 (11%) did not have acute appendicitis. The remaining 227 (89%) did have acute appendicitis at varying pathological stages (Table 1).

Of 27 patients without acute appendicitis, four had a normal appendix with no signs of abdominal pathology at operation. One of these subsequently showed signs of pneumonia on radiograph. Of the remaining patients, 17 had such other abdominal conditions as acute mesenteric adenitis (12), ruptured ovarian cyst (three), acute pancreatitis (one), and gastroenteritis (one). The remaining six had acute periappendicitis with no other abdominal pathology (four), subacute mesenteric adenitis (one), and appendiceal fibrosis (one). There were no deaths.

There is a seasonal variation of acute appendicitis, with more cases during winter and summer months ($P < .001$) (Figure 1). There is no clear explanation for this, although it may be related to enteral viral infections.

Pathological stage of the disease was directly related to duration of pain before admission to the hospital (Table 2). The mean duration of pain for all stages of acute appendicitis was 1.5 days, with a range of one to 15 days.

Mean patient age was 25.3 years ($s = 15.9$), with a range of 4 to 80 years in the group of 227 patients with acute appendicitis (Table 3). Of these patients, 131 (58%) were male patients and 96 (42%) were female patients.

Evaluation of Findings

Of the initial 305 records, 28 were excluded from statistical evaluation because of incomplete clinical information. The study included 277 patients (227 with acute appendicitis, 50 without acute appendicitis).

To summarize the results, a statistical 2 × 2 table was made for each

TABLE 1. *Pathological stages of acute appendicitis*

Stage	No.	(%)
Simple	108	47
Suppurative	67	30
Gangrenous	15	7
Perforated	34	15
Abscessed	3	1
Total	227	100

TABLE 2. *Duration of pain in acute appendicitis*

Stage	No.	Range (days)	Mean (days)
Simple	108	1-5	1.2
Suppurative	67	1-4	1.2
Gangrenous	15	1-3	1.5
Perforated	34	1-5	2.7
Abscessed	3	5-15	9.3
All cases	227	1-15	1.5

$F > F.99$; $P > .001$.

TABLE 3. *Age in acute appendicitis*

Stage	No.	Range (y)	Mean (y)
Simple	108	4-80	23.5
Suppurative	67	6-63	22.3
Gangrenous	15	7-65	36.3
Perforated	34	9-68	29.0
Abscessed	3	49-60	53.0
All cases	227	4-80	25.2

TABLE 4. *Evaluation of clinical and laboratory findings in acute appendicitis*

Diagnostic Indicants	Sensitivity P(T+ | D+)*	Specificity P(T− | D−)	Predictive Value P(D+ | T+)	Predictive Value P(D− | T−)	Joint Probability P(T+&D+)	Joint Probability P(T−&D−)	Diagnostic Weight
Migration	.69	.84	.95	.37	.57	.15	.72
Anorexia-acetone	.61	.72	.91	.29	.50	.13	.63
Nausea-vomiting	.74	.36	.84	.23	.60	.06	.66
Tenderness	1.00	.12	.83	1.00	.82	.02	.84
Rebound pain	.55	.78	.92	.27	.45	.14	.59
Elevation	.73	.50	.87	.29	.60	.09	.69
Leukocytosis	.93	.38	.87	.53	.76	.07	.83
Shift	.71	.68	.91	.34	.58	.12	.70
Rectal tenderness	.53	.41	.69	.26	.38	.11	.49

*P, probability; T, test, sign, or symptom; D, disease.

TABLE 5. *Evaluation of clinical and laboratory findings in nonacute appendicitis*

Diagnostic Indicants	Sensitivity P(T+ | D+)*	Specificity P(T− | D−)	Predictive Value P(D+ | T+)	Predictive Value P(D− | T−)	Joint Probability P(T+&D+)	Joint Probability P(T−&D−)	Diagnostic Weight
Migration	.16	.31	.05	.62	.03	.25	.28
Anorexia-acetone	.28	.39	.09	.70	.05	.32	.37
Nausea-vomiting	.64	.26	.16	.77	.11	.21	.32
Tenderness	.88	0	.16	0	.16	0	.16
Rebound pain	.22	.45	.08	.72	.04	.37	.41
Elevation	.50	.27	.13	.71	.09	.22	.31
Leukocytosis	.62	.07	.13	.47	.11	.06	.17
Shift	.32	.29	.09	.66	.06	.24	.30
Rectal tenderness	.59	.47	.31	.74	.17	.34	.51

*P, probability; T, test, sign, or symptom; D, disease.

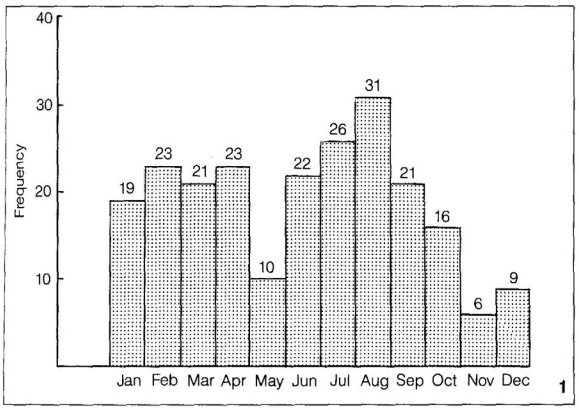


FIGURE 1. *Frequency distribution of acute appendicitis during the year. N=227; X^2= 31.77; P < .001.*

diagnostic indicant, and from these tables an estimate of probabilities, sensitivity, specificity, and predictive values was calculated.[10]

The "ideal test" should be 100% sensitive and 100% specific, and should have a predictive value of 100%. Also, there should be no false-positive or false-negative results, so that the total joint probability should add up to 100%. A diagnostic weight of such a test should be 1.0. This is obtained by adding the joint probability of a negative test to the joint probability of a positive test.

The joint probabilities were calculated directly by dividing the total number of patients by the number of true-positive or true-negative tests. Using this method, a diagnostic weight for each clinical and laboratory finding was assigned (Tables 4, 5, and 6 and Figures 2 and 3). This should indicate the diagnostic accuracy of each test because it considers only the true-positive and true-negative results.

Analysis of Diagnostic Indicants

Migration of pain. Pain usually starts in the epigastrium or periumbilical area and in a few hours migrates to the right lower quadrant. This symptom had a good predictive value (0.95) and a good specificity (0.84). Its sensitivity, however, was only fair (0.69) (Table 4).

Anorexia-acetone. One of the specific symptoms of acute appendicitis is anorexia,[1,8,11] which may be associated with acetone in the urine. We can use this as an indirect sign of anorexia. Thus anorexia or acetone in the urine (or both) has a fair sensitivity (0.61) but a good positive predictive value (0.91). Its specificity, however, is only fair (0.72).

Nausea-vomiting. The symptom complex of nausea and vomiting[1,5,11] has a good sensitivity (0.74) but a poor specificity (0.36), and its predictive value is good (0.84).

Tenderness. The most common sign of acute appendicitis is tenderness in the right lower quadrant, especially at the McBurney's point.[1,5] Tenderness has an excellent sensitivity (1.00) and excellent predictive value (1.00), but a poor specificity (0.12). Its positive joint probability is good (0.82) but its specificity is poor (0.12) (Table 4).

Rebound pain. Although this sign is sometimes difficult to elicit, direct rebound pain is one of the specific signs of acute appendicitis (0.78 specificity). Rebound pain has a good predictive value (0.92) but a poor sensitivity (0.55).

Elevation of temperature. Initial slight temperature elevation, defined as oral temperature ≥ 37.3 C, is a common finding in acute appendicitis.[1,5] It has a fairly good sensitivity (0.73) but a poor specificity (0.50). Slight fever, however, has a good predictive value (0.87).

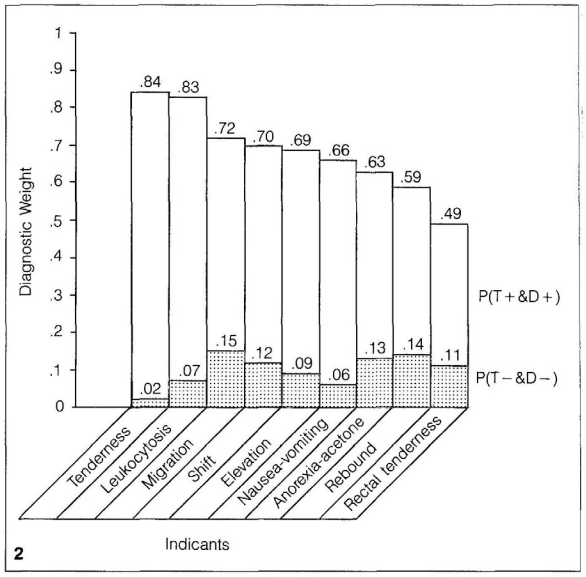
Leukocytosis. A white blood count above 10,000 is a valuable finding in

TABLE 6. *Evaluation of clinical and laboratory findings in acute mesenteric adenitis*

Diagnostic Indicants	Sensitivity P(T+ | D+)*	Specificity P(T− | D−)	Predictive Value P(D+ | T+)	Predictive Value P(D− | T−)	Joint Probability P(T+&D+)	Joint Probability P(T−&D−)	Diagnostic Weight
Migration	.15	.94	.29	.77	.02	.78	.80
Anorexia-acetone	.29	.39	.08	.76	.04	.34	.38
Nausea-vomiting	.56	.15	.10	.67	.08	.13	.21
Tenderness	.88	0	.13	0	.13	0	.13
Rebound pain	.15	.45	.04	.75	.02	.38	.40
Elevation	.39	.25	.08	.70	.06	.21	.27
Leukocytosis	.56	.11	.10	.60	.08	.10	.18
Shift	.29	.29	.07	.70	.04	.25	.29

*P, probability; T, test, sign, or symptom; D, disease.

FIGURE 2. *Indicants and their diagnostic weights in acute appendicitis.*



acute appendicitis.[1,5,7,8] Leukocytosis has a good sensitivity (0.93) and a good predictive value (0.87); however, its specificity is low (0.38).

Shift to the left. A differential white count with shift to the left (eg, neutrophils of more than 75%) is also a useful indicant in acute appendicitis.[1,7] It has a good predictive value (0.91) but a fair sensitivity (0.71).

Urinalysis. Routine urinalysis should be done to rule out a urinary tract infection. Slight elevation of white cells in the urine could be due to the inflammatory process of acute appendicitis near the ureter or bladder.[12] Very frequently, patients with acute appendicitis show a few red blood cells in the urine; however, this is nonspecific.[1]

Rectal examination. Of 95 patients who had documented rectal examination in this series (Table 4), 52 had right-side rectal tenderness (0.55 estimate of the test outcome). Of 68 patients with confirmed acute appendicitis, 36 had rectal tenderness (0.53 sensitivity), and of 52 patients with positive rectal examination, 36 proved to have acute appendicitis (0.69 predictive value). In this subgroup of 95 patients with suspected acute appendicitis, 36 had acute appendicitis (0.38 positive joint probability). The total diagnostic weight of rectal tenderness was 0.49, which is too low to be considered a reliable sign.[1,5,7,8] Rectal examination, however, could be helpful when a pelvic abscess is suspected.

Pelvic examination. A pelvic examinationis useful to confirm gynecological disorders.

Other Abdominal Pathology

Of 305 patients studied, 41 were discharged with the diagnosis of possible or confirmed acute mesenteric adenitis. Of these, 29 were observed and treated nonoperatively. The remaining 12 had laparotomies that showed normal appendices but clear signs of acute mesenteric adenitis.

The age range in acute mesenteric adenitis was 5 to 26 years with a mean of 11.5 years (s = 4.8), which is lower than in acute appendicitis (25.3 years) ($P < .001$) (Table 3).

The male:female ratio was 14:27 (34% male), which is the opposite of the ratio of appendicitis (58% male) ($P < .005$).

Pain duration in acute mesenteric adenitis prior to admission was from

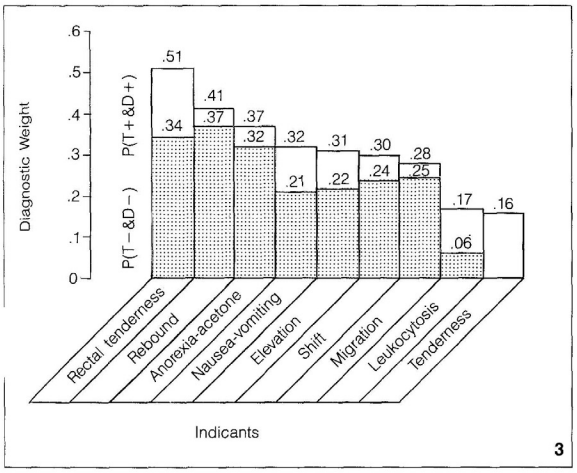


FIGURE 3. *Indicants and their diagnostic weights in nonappendicitis.*

TABLE 7. *Mnemonic for the diagnostic score of acute appendicitis: MANTRELS*

		Value
Symptoms	**M**igration	1
	Anorexia-acetone	1
	Nausea-vomiting	1
Signs	**T**enderness in right lower quadrant	2
	Rebound pain	1
	Elevation of temperature	1
Laboratory	**L**eukocytosis	2
	Shift to the left	1
Total score		10

TABLE 8. *Mean score and sample standard deviation for different stages of acute appendicitis*

Stage	N	$\bar{x}$	s
Simple	108	7.40	1.49
Suppurative	67	7.92	1.66
Gangrenous	15	7.73	0.96
Perforated	37	8.21	1.45

one to 12 days, with a mean of 2.6 days; this was longer than pain duration in acute appendicitis (1.5 days) ($P < .001$) (Table 6).

Clinical and laboratory findings were much less sensitive than in acute appendicitis.

The most sensitive signs in acute mesenteric adenitis were tenderness in the right lower quadrant (0.88) and leukocytosis (0.56) but the specificity of these two signs was too low (0 and 0.11, respectively). In addition, the diagnostic weight of tenderness and leukocytosis was low (0.13 and 0.18, respectively). Migration of pain, however, had a high diagnostic weight (0.80), due primarily to its high negative joint probability (0.78).

In our series, three patients had ruptured ovarian cysts that required laparotomy. Age range was from 13 to 31 years and pain duration was from one to 6 days, with a mean of 2.6 days.

The most noticeable sign was rebound tenderness, with a sensitivity of 0.66 and a predictive value of 0.15. All the remaining signs and symptoms showed very low diagnostic weights.

DISCUSSION

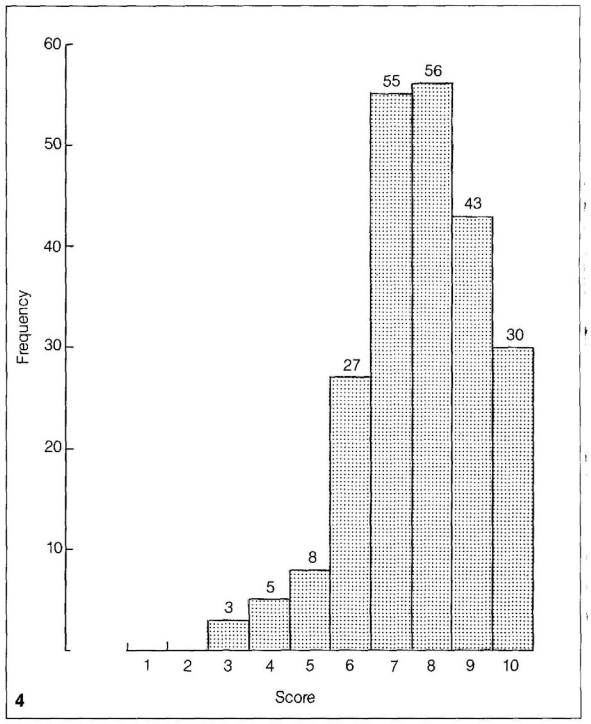
Three symptoms (migration, anorexia, and nausea-vomiting), three physical signs (tenderness, rebound pain, and elevation of temperature), and two laboratory findings (leukocytosis and shift to the left) appear to be useful in the diagnosis of acute appendicitis. If we assign a small number to the diagnostic weight of each indicant (Table 4), we obtain a workable score that can be used in practice (Table 7).

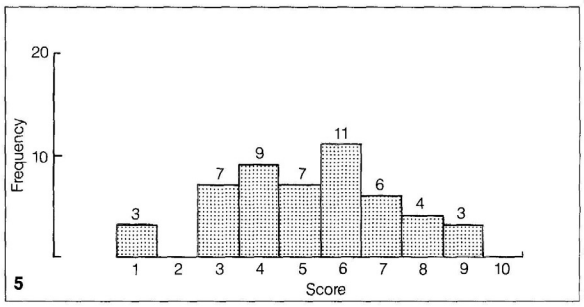
If we assign a value of 2 to the more important elements (tenderness, leukocytosis) and a value of 1 to the remaining elements, we reach a total, perfect score of 10. A score of 5 or 6 is compatible with the diagnosis of acute appendicitis. A score of 7 or 8 indicates a probable appendicitis, and a score of 9 or 10 indicates a very probable appendicitis.

This system does not give a 100% certainty because there is the chance of overlapping of symptoms with other diseases. There is no sign, symptom, or laboratory test that is 100% reliable in the diagnosis of acute appendicitis (Figure 2). This test should have a diagnostic weight of 1.0; however, we can use the diagnostic score as a guide to decide if the patient needs observation or surgery. A patient with a score of 5 or 6 may be observed; a patient with a score of 7 or

FIGURE 4. *Frequency distribution according to the diagnostic score in all cases of acute appendicitis. N=227; $\bar{x}=7.71$; $s=\pm 1.53$.*

FIGURE 5. *Frequency distribution according to the diagnostic score in nonacute appendicitis. N=50; $\bar{x}=5.24$; $s=\pm 2.02$.*





more requires surgery.

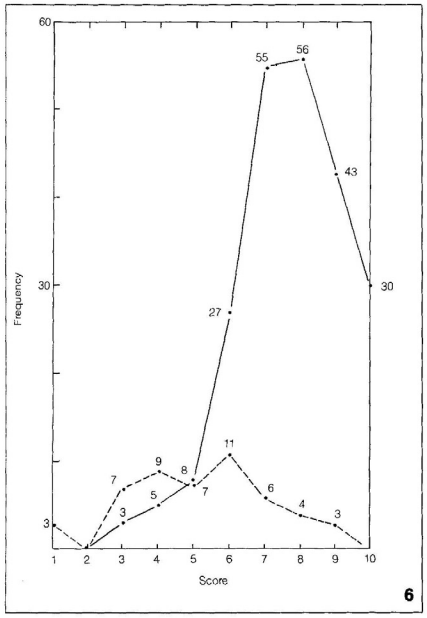
Certain symptoms and physical signs are not always easy to elucidate, especially in young children or mentally impaired patients. If there is any doubt about the presence of a determined sign or symptom, however, it is safer to recognize a sign or symptom as present even if its manifestation is not quite clear. Under these circumstances the diagnostic score should be correlated with the clinical impression of the examiner because there is always an intangible ingredient in the diagnosis of acute appendicitis. If there is any question about the diagnosis, more physical examinations and laboratory tests should be performed and the patient should be evaluated every four or six hours, preferably in the hospital.[5,6,8] If the score remains the same or increases after this reevaluation, the patient may need laparotomy.

The diagnosis of acute appendicitis is more difficult in women because of the presence of gynecological disorders. In these cases a pelvic examination is essential because it can reveal the missing information. A rectal examination does not appear to be a reliable element in the diagnosis of acute appendicitis because of its low diagnostic weight.[1,5,7,8]

Statistical Aspects of the Score

Eight predictive factors were found to be useful in making the diagnosis of acute appendicitis. The order of importance of each, according to its diagnostic weight, was as follows: localized tenderness in the right lower quadrant (0.84), leukocytosis (0.83), migration of pain (0.72), shift to the left (0.70), temperature elevation (0.69), nausea-vomiting (0.66), anorexia-acetone (0.63), and direct rebound pain (0.59).

The chi-square statistic was calculated for each of the diagnostic indicants. The highest number (48.08) corresponded to migration of pain followed by leukocytosis (33.79), tenderness (27.91), shift to the left (26.90), anorexia-acetone (18.27), and rebound pain (17.43). All of these numbers were statistically significant ($P < .001$). The chi-square for elevation of temperature was 10.23 ($P < .01$). The lowest figures corresponded to nausea-



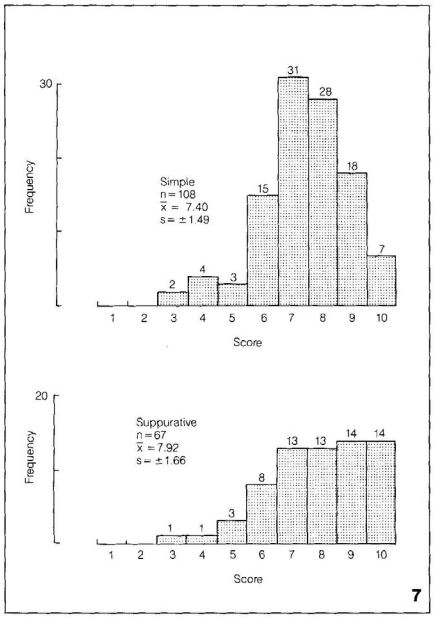


FIGURE 6. *Polygon of frequency distribution in appendicitis and nonappendicitis.*

FIGURE 7. *Frequency distribution according to the diagnostic score in simple and suppurative appendicitis.*

vomiting (2.03) and rectal tenderness (0.29), with P values of less than .2 and .5, respectively.

The diagnostic score for acute appendicitis is different than that for nonappendicitis (Figures 4 and 5). The mean score for acute appendicitis (n = 227) is 7.71 (s ± 1.53) and the mean score for nonappendicitis (n = 50) is 5.24 (s ± 2.02).

Using a polygon of frequency distribution (Figure 6) we can compare the diagnostic score for acute appendicitis with that for nonappendicitis. If we choose a decision cutoff point of 6, (either to operate for appendicitis or observe the patient) we will have 16 potential perforations (5.8%) and 24 unnecessary operations (8.7%). If we choose a cutoff point of 5, the potential perforations drop to 8 (2.9%), but the unnecessary operations rise to 31 (11.2%). The diagnostic score is flexible enough to allow for making the decision on an individual basis.

The mean score increases in relation to the stage of the disease, from 7.40 in simple appendicitis to 8.21 in the subgroup of perforated-abscessed appendicitis (Table 8). For some reason, however, in gangrenous appendicitis, the mean score is slightly lower than the mean score for suppurative appendicitis. This may reflect the famous "treacherous calm" of Dieulafoy, in which the pain and tenderness subside temporarily during the gangrenous stage of the disease.[12]

The frequency distribution according to the score at different stages of acute appendicitis (Figures 7 and 8) shows that in suppurative appendicitis, the histogram is markedly skewed to the right, indicating that at this stage we will have the maximum constellation of signs and symptoms.

Application of the Diagnostic Score

In the group of patients with acute appendicitis, 17 had a normal WBC; four of these patients had a shift to the left. Tenderness was present in all patients, and migration of the pain was found in 14. The diagnostic score ranged from 4 to 7, with an average of 5.56. There was one case of gangrenous appendicitis and another of perforated appendicitis with normal WBC, but the scores were 7 and 6, respectively. Four patients had acute appendicitis with normal WBC and a score of 4, but they were in the early stages of the disease.

One case of subacute appendicitis was associated with mesenteric adenitis. The patient had tenderness in the right lower quadrant, but his diagnostic score was 4. Retrospectively, perhaps an unnecessary laparotomy could have been prevented. There was another case of appendiceal fibrosis that justified laparotomy because the diagnostic score was 9. One patient with acute pancreatitis and periappen-

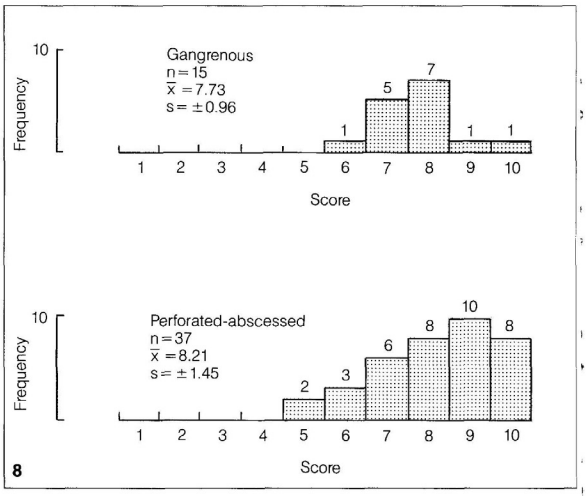


FIGURE 8. *Frequency distribution according to the diagnostic score in gangrenous and perforated-abscessed appendicitis.*

dicitis had tenderness and rebound pain in the right lower quadrant and a diagnostic score of 9; therefore, a laparotomy was indicated.

One case of acute appendicitis associated with *Salmonella typhimurium* presented with tenderness and rebound pain in the right lower quadrant and profuse diarrhea. The diagnostic score was 7. Another patient with periappendicitis associated with regional enteritis had a diagnostic score of 4; however, it was difficult to argue against laparotomy in this case.

Six cases of acute appendicitis were accompanied by lymphoid hyperplasia. All had tenderness in the right lower quadrant and a mean diagnostic score of 6.8. Two patients with acute appendicitis associated with mesenteric adenitis had a diagnostic score of 9. In both, the WBC count was elevated.

One patient, a 35-year-old man, complained of severe abdominal pain but had no abdominal tenderness. His temperature was 38.8 C and his WBC was 24,000. A subsequent chest roentgenogram revealed a right lower lobe pneumonia. However, his diagnostic score was 4, and in this case, with a more thorough clinical evaluation, an appendectomy could have been avoided.

One patient with *situs inversus* presented with tenderness and rebound pain in the left lower quadrant. His diagnostic score was 8. At laparotomy a gangrenous appendix was found.

Failure to make an early diagnosis is one reason for the persistently high rate of complications and mortality in acute appendicitis.[1-3] The problem is to secure an early diagnosis using customary clinical and laboratory methods. Several score systems have been devised, but they are cumbersome and difficult to memorize.[8,13] Some[4,8,11,13] require the use of computers, which may not be feasible in all clinical settings. In one study, Computer-aided diagnosis to avoid the negative laparotomy in suspected appendicitis offered no advantage over unaided clinical diagnosis.[11]

CONCLUSION

We demonstrated that it is possible to approach patients in a rational manner using a simple diagnostic score that might indicate which patients should be observed and which should have surgery. This score is based on symptoms, signs, and laboratory findings commonly present in acute appendicitis. We applied Bayesian analysis,[11,13,14] in which we used prior information obtained from clinical experience to make a reasonable decision. The proposed scoring system is applicable in all clinical situations and does not require the use of a computer.

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Kurt Semm and the Fight against Skepticism: Endoscopic Hemostasis, Laparoscopic Appendectomy, and Semm's Impact on the "Laparoscopic Revolution"

Grzegorz S. Litynski

ABSTRACT

In the 1970s, Semm developed thermocoagulation, adapted the Roeder Loop, and further invented extra- and intracorporeal endoscopic knotting to achieve endoscopic hemostasis. His numerous technical inventions, especially the electronic insufflator, allowed more complex operations to be performed laparoscopically. His technique, however, was not quickly adopted by the surgical community. When the first fully laparoscopic appendectomy was carried out by Semm in 1980, a veritable storm broke loose. In the opinion of many prominent surgeons, Semm exaggerated the problem of adhesions, and laparoscopic technique itself was regarded as very dangerous. Misunderstood by medical scientists, Semm displayed an ability to force his ideas through despite skepticism and suspicion. He realized that endoscopic surgery had tremendous potential, and promoted laparoscopic technique not only in his field of gynecology but among general surgeons as well. In 1985, Muhe, of Boblingen, Germany, used Semm's technique to remove the first gallbladder in the world laparoscopically. Three years later when Semm presented a videotape of his laparoscopic appendectomy in Baltimore, he gave impetus to McKernan and Saye of Marietta, Georgia, to carry out the first laparoscopic cholecystectomy in the United States.

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ENDOSCOPIC HEMOSTASIS

In the early 1970s, Semm became a dynamic proponent of thermocoagulation. He published several articles (in German and English) and devoted much space in his 1976 book "Pelviskopie und Hysteroskopie" to a discussion of the thermocoagulation technique. There he concluded that the use of high frequency current developed for major surgery "is not free of incalculable risk for gynecological endoscopy."[1] In his opinion, "high frequency current was introduced into endoscopy in an almost thoughtless way with no consideration of physics and technology."[2]

The invention of thermocoagulation, even though it did not find wide acceptance among gynecologists, was Semm's first step to finding a solution for controlling intraoperative bleeding. Semm did not limit his research on hemostasis to thermocoagulation, but forged ahead into other areas. A crucial innovation in laparoscopic surgery was his development of intra- and extracorporeal knots **(Figure 1)**.

Loop Ligator

In February 1994, Semm recalled the early days of Roeder Loop application in endoscopic surgery:

> I had a patient from Persia. She had come to have a sterilization done and had a visa for only three days. Fate would have it that she got a net-bleeeding and normally a laparotomy would be necessary to get the bleeding under control. I thought that maybe the Roeder Loop, that we have used for years during Wertheim hysterectomies, could be the solution. But I had no instrument to get the dumb loop into the abdomen. So I improvised, and it worked! It was 1975 or 1976. By 1977 in our clinic the loop ligature had become routine in adnexectomy.[3]

Semm announced the invention of his loop-applicator in several publications, both in German and English.[4] One can not help but note that the ability to introduce the Roeder Loop into a normal 5 mm trocar gave him a feeling of self-confidence: "After the loop became routine, I thought to myself that I could do everything in a different way."[5]

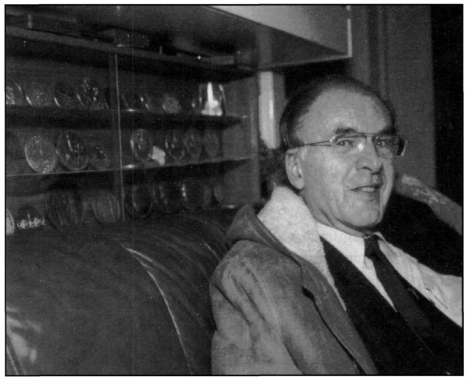

Figure 1. Kurt Semm in his office at the University of Kiel, February 1994. (Figure C-4 in *Highlights in the History of Laparoscopy.*)

Laparoscopic Suturing

The idea of performing laparoscopic suturing became an obsession. Semm thought about it all the time. How could suturing be performed inside the abdominal cavity? One day, on a plane en route from the United States to Germany, Semm came to the conclusion that fashioning a knot outside the abdominal cavity and then transferring the knot inside the abdomen could be a solution. As the plane reached Frankfurt am Main Airport, Semm already had the concept of the new technique. Soon, extracorporeal knotting was introduced into the Women's University Clinic in Kiel. "From there it went step by step: the intracorporeal knot, the microsuture. And everybody said, "He's gone absolutely crazy," remarked Semm.[6]

Further Technical Developments. "A New Era of Gynecologic Surgery"

Semm was an amazingly fruitful inventor, an endless source of new ideas. His endocoagulator (using a 12 V energy source) achieved coagulation hemostasis at 100 degrees Celsius. The aquapurator alternated insufflation and aspiration of physiologic saline solution. In Semm's opinion, this lavage was instrumental in the prevention of postoperative adhesions. Another key invention was the electronic insufflator, which measures, electronically and continuously, intra-abdominal pressure and replaces lost carbon dioxide, enabling repeated instrument changes **(Figure 2)**. The electronic insufflator allowed more complex operations to be performed by making the technical side of the operation similar to conditions which exist under general surgery. In 1979, Semm announced that the new technical equipment had opened up "a new era of gynecologic surgery."[7]

Semm found an effective way to bring his inventions into practice. Semm's brother and father, owners of the medical instrument company, WISAP, produced instruments for him almost overnight.[8] It gave Semm a period of only weeks between design of a device and its introduction into clinical use, while others waited years for their ideas to be realized. This made Semm a lot of enemies.

Semm's numerous innovations in the field of laparoscopy significantly expanded the spectrum of operative possibilities. Already in the late 1970s his list of laparoscopic procedures included myomectomy, ovariectomy, ovarian cysts resection, adnexectomy, treatment of tubal pregnancy, and many others.[9] The sky-rocketing numbers of operations performed by Semm astonished everyone. Many received the reports with disbelief, maintaining that such feats were impossible. Some theorized that he only began his operations laparoscopically but completed them conventionally. Those, however, who witnessed him in action spoke of "the magician of Kiel," and "the chairman of the Magic Club."[10] A feeling for Semm's impact can be gained from a comment on Semm's technique by an astonished observer who asked in the February 1, 1980 issue of "Medical

Figure 2. Semm's electronic insufflator. (Figure C-4 in *Highlights in the History of Laparoscopy.*)

Figure 3. A gynecologist teaching surgeons. . . . Left to right: Semm, Buess, and Gotz. (Figure C-6 in *Highlights in the History of Laparoscopy.*)

Tribune": "When will the first appendix or gallbladder disappear into an endoscope?"[11] The first half of this question did not wait long for an answer. On September 13 of the same year, Semm performed the first fully laparoscopic appendectomy.[12]

LAPAROSCOPIC APPENDECTOMY

In the 1980s, the gap between surgeons and gynecologists was immense. Many surgeons believed that gynecologists had "operation envy," that "real" operations were exclusively the domain of surgery, not gynecology. To a practitioner of another specialty, operations such as appendectomy must remain forever unattainable. Gynecologists were thought to suffer from inferiority complexes. Semm's entrance into general surgery was seen, then, as the attempt of an over-ambitious gynecologist to bolster his "operation ego." Surgeons, hypersensitive to a shrinking of their field, could not appreciate the fact that Semm had actually offered them a chance to regain some of their prestige.

Surgeons' Criticism

Semm describes the reaction of the medical world to the announcement of laparoscopic appendectomy as the "worst criticism" he had received in his career. "Both surgeons and gynecologists were angry with me, they were throwing stones at me. All my initial attempts to publish on laparoscopic appendectomy were refused, with the comment that such nonsense does not and will never belong to general surgery," he complained.[13] Surgeons saw no reason to change a well-established working method into a complicated technical matter. Their unfamiliarity with laparoscopic technique left them unprepared for "culture shock," for a complete reworking of surgical concepts.[14] Additionally, surgeons had an aversion to granting outsiders competency in their field. A gynecologist teaching a surgeon how to perform an operation was simply unthinkable. That this is exactly what Semm did is evidenced by his publication "Operative Manual for Endoscopic Abdominal Surgery" (1984).[15] Semm had crossed a border, hitherto seen as impassable **(Figure 3)**.

Although detailed descriptions of laparoscopic appendectomy were not published until 1982 in the United States[16] and 1983 in Germany,[17] this in no way means that discussion of the topic did not occur in medical circles. Semm's operation caused a furor.[18] In March 1983, a journalist of "Medical Tribune" summarized the major criticisms aimed at Semm:

> Semm exaggerates the problem of adhesions only in order to find a justification for his key-hole surgery. . .Thanks to modern methods of anesthesia, laparotomy today no longer poses a problem. This is the only way for a surgeon to be able to view the entire abdomen and to direct his procedure accordingly. Postoperative adhesions can lead to complications, but they in no way occur with such frequency that one must switch to endoscopic operations, believes Prof. Bruecke. Many superfluous operations are being carried out even today. The danger in expanding the endoscopic appendectomy, which only seems to be easier and lessdangerous to perform than conventional methods, is that still more unnecessary appendectomies will be per-formed than have been to date. We thus face the following fundamental question: Do the advantages of endoscopic operations—avoidance of laparotomy, diminishing the pain of the incision, early mobilization, and avoidance of post-operative adhesions—outweigh the disadvantages—greater expenditure on technology and more complicated methods of operating?[19]

Semm's technique was generally considered too dangerous for the the patient. Many believed that he was going too far. Even laparoscopists thought Semm had exaggerated, that it was unnatural to try and make a surgical instrument out of a diagnostic tool. Michael Mintz, one of Palmer's close associates in Paris, confirms that numerous critics of Semm attacked him for publishing only the technical side of his technique without mentioning his patients or offer-

ing statistics to back up the clinical safety of laparoscopy and laparoscopic surgery.[20] When Semm did publish genuine statistical information concerning the clinical safety of the laparoscopic procedure, a true storm broke loose.

Gynecologists' Criticism

Frangenheim unofficially took upon himself the role of speaker for a group of physicians who were seriously concerned by Semm's activities. His criticism of Semm illustrates and dramatizes the widely diverging attitudes and approaches to laparoscopy which had formed in the late 1970s.

Frangenheim's opening remark in the 1979 issue of "Geburtshilfe und Frauenheilkunde" indicated that the discussion would be highly charged. "So we now have the published statistics on the situation of laparoscopy in Germany from Semm. What impressive numbers, and how little they tell us!" he scoffed.[21] He then attacked Semm's figures as "not neutral" and for their reference to specific manufacturers. Semm's thermocoagulation received a special measure of criticism. Frangenheim claimed that sterilization by thermocoagulation resulted in a higher pregnancy rate than high-frequency current sterilization. Laparoscopists "are moreover in the position to handle monopolar high-frequency current carefully," he maintained. "These operators refuse to tolerate such arrogant tutelage in what they should do and not do." Frangenheim also criticized Semm's enthusiasm for the "Roeder Loop," claiming that the device exceeded the scope of the routine laparoscopist. "The operation is only for 'artists,'" he wrote. For the patient, maintained Frangenheim, there was less risk in the use of laparotomy to diminish serious bleeding.

SEMM'S INFLUENCE ON MODERN SURGERY

In the last few decades, medical breakthroughs and inventions have been accomplished by highly specialized research teams, or even industrial concerns. Semm completely departed from this model, and in one person united physician, researcher, and technician. Being the director of a university clinic, he had a large range of possibilities at his disposal. He vigorously applied these resources to the advancement of laparoscopy. Misunderstood by medical scientists, he displayed an ability to force his ideas through despite skepticism and suspicion. Semm realized that endoscopic surgery had tremendous potential not only in the field of gynecology but in general surgery as well. He continued to promote laparoscopic surgery led by a vision of lessening trauma for the patient. In 1981, for example, he took a daring step and invited Hans Troidl (b. 1938), a professor of general surgery at the Kiel Surgical Clinic, to assist him during laparoscopic appendectomy.[22] When Semm presented his technique at a 1983 Endoscopy Congress in Erlangen, he convinced Bernd C. Manegold of Mannheim, a prominent German surgical endoscopist, that "Laparoscopic cholecystectomy and the bowel anastomosis under laparoscopic vision had moved into the domain of the possible."[23] Following Semm's lead, Friedrich Goetz and Arnold Pier, two German general surgeons, began conducting surgical laparoscopy on a large scale. By the early 1990s, they carried out hundreds of laparoscopic appendectomies and went on to perfect the technique even for acute appendicitis.[24]

Laparoscopic Cholecystectomy and "Laparoscopic Revolution"

In 1985, Erich Muhe (b. 1938), a professor of surgery in Boblingen, Germany, used Semm's instruments and technique to remove the first gallbladder in the world laparoscopically.[25] Three years later, when Semm presented a videotape of his laparoscopic appendectomy in Baltimore, he gave impetus to J. Barry McKernan (general surgeon) and William B. Saye (gynecologist) of Marietta, Georgia, to carry out the first laparoscopic cholecystectomy in the United States.[26]

Shortly thereafter the "laparoscopic revolution" broke out, and Semm's laparoscopic expertise was in great demand **(Figure 4)**. His publications on the subject, translated into many languages, were read across the world by thousands of surgeons. Without Semm's input, the development of a "Laparoscopic Revolution," while perhaps inevitable, would have been postponed by many years. Thanks to him medicine made a tremendous leap forward.[27]

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22. "It was a Sunday, I remember, because he [Semm] used to perform his innovative procedures on the weekend. I believe this took place in 1981, shortly before I left for Cologne in October of that year." To Troidl, the endoscopic appendectomy with Semm was "unforgettable experience." Troidl H. Interview by GS. Litynski, tape recording, October 11,1995. In Litynski GS. *Highlights in the History of Laparoscopy.* Frankfurt, Germany: B. Bernert Verlag; 1996

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26. After Semm's video presentation during a seminar in Baltimore (April 1988), McKernan and Saye approached the German gynecologists. "Since in those days endoscopic instruments were very short in our hospital, we decided to buy our own instruments at our own cost. Semm took us over and we (McKernan and Saye) wrote him a check." McKernan JB., interview by GS. Litynski, tape recording, March 20, 1996. In Litynski GS. *Highlights in the History of Laparoscopy.* Frankfurt, Germany: B. Bernert Verlag; 1996

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