

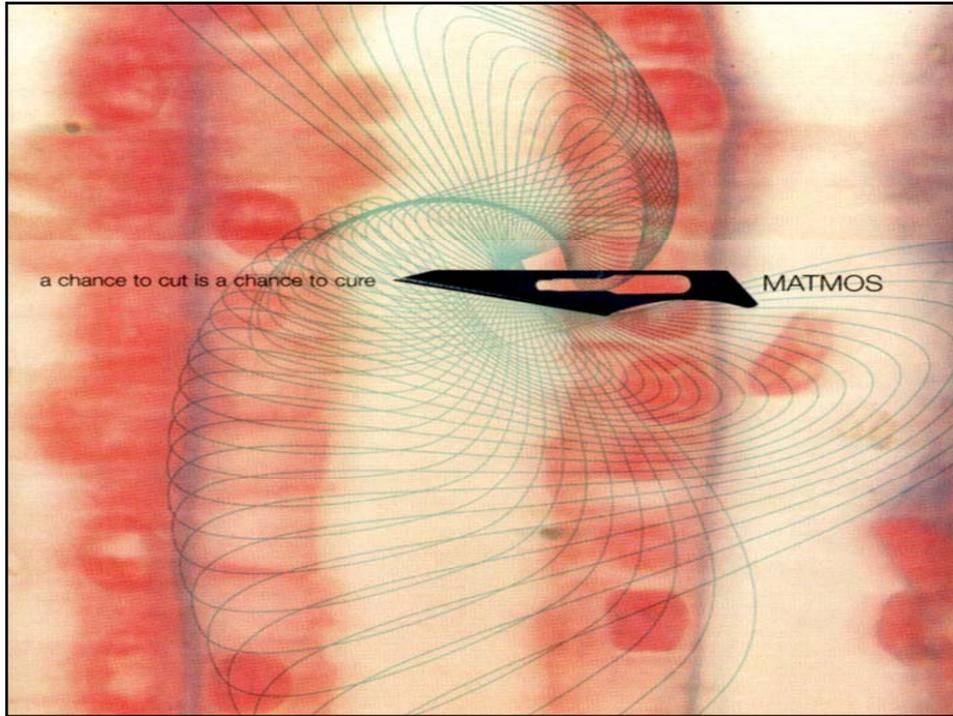
Appendicitis: Antibiotics Alone (Is the Answer)

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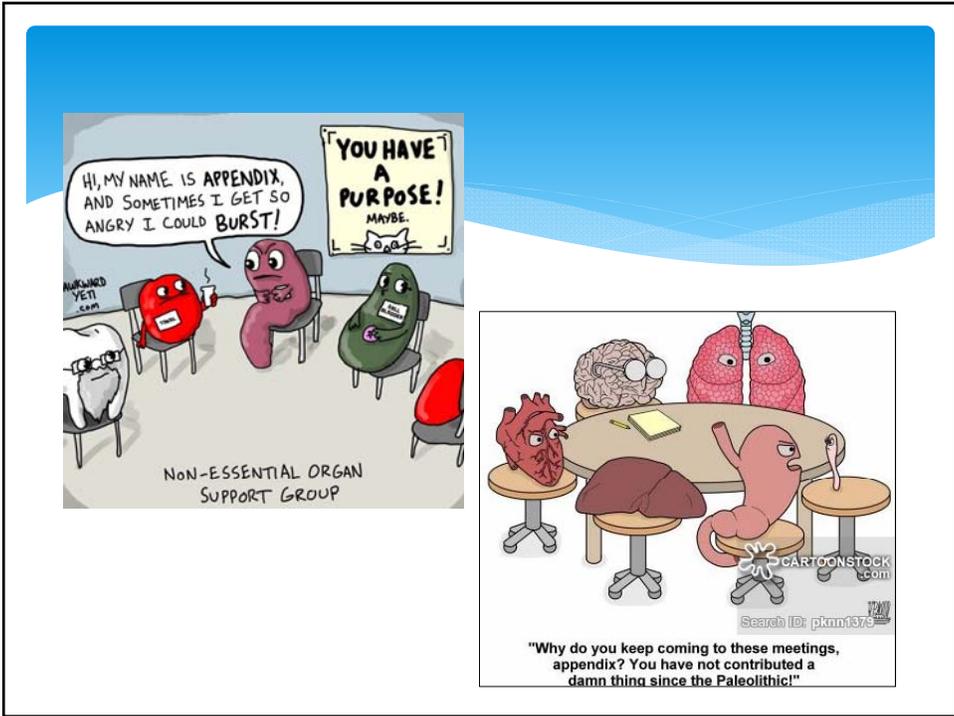
I have no disclosures or
conflicts of interest.





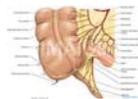
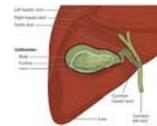
COMMON INTRA-ABDOMINAL SURGICAL EMERGENCIES

- * Cholecystitis – evidence for delayed surgical therapy
- * Pancreatitis – non operative management
- * Diverticulitis – evidence for delayed surgical therapy
- * Appendicitis Surgery



IS BIGGER ALWAYS BETTER?

- * Sigmoid colon – 2,066.12 sq. cm
 - * SOC – Antibiotics, NPO/IV fluids. Resection if peritonitis/shock
- * Gallbladder – 471 sq cm & 25.94 cm³
 - * SOC – Antibiotics, delayed cholecystectomy
 - * SOC – Peritonitis/shock → Cholecystostomy tube
- * Appendix – 48.87 sq cm
 - * SOC – acute → resection
 - * SOC – perforated → resection
 - * SOC – abscess/phelgmon → Abx/drainage
 - * **SOC – antibiotics???**



SURGERY VS ANTIBIOTICS:

- * The costs of surgery
- * The risks of surgery
- * Does antibiotic therapy work?

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WHAT DOES AN APPENDECTOMY COST?



"I'll be removing your appendix and Dr. Otto will assist in removing a portion of your disposable income."

WHAT'S AN OPERATION WORTH?

- * Diverticulitis
 - * Insured: surgeon/hospital copay, coinsurance of 10-50%
 - * Colectomy: \$30,000-\$50,000
- * Cholecystectomy
 - * Insured: surgeon/hospital copay, & coinsurance of 10-50%
 - * Surgery: \$10,000-\$20,000
- * Appendectomy
 - * Insured: surgeon/ER copay, coinsurance of 10-50%%
 - * Surgery: \$10,000-\$35,000

Costhelper, Inc 2014

By MICHELLE CASTILLO / CBS NEWS / January 2, 2014, 11:54 AM

Cost of an appendectomy? Reddit user posts \$55,000 bill

14 Comments / Shares / Tweets / Stumble / Email More +

AP / April 23, 2012, 11:24 PM

Study: Appendix surgery costs differ around U.S.

Brody et al, J Archives Int Med 2012

SURGERY VS ANTIBIOTICS

- * The costs of surgery
- * **The risks of surgery**
- * Does antibiotic therapy work?

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Admittedly, we're pretty good at Appendectomy



The appendectomy quarterfinals.

Why should we consider nonoperative therapy?

- * Operative complications
 - * Anesthesia-induced complications, enterotomies, urinary tract lesions, vascular injuries
- * Post-operative complications
 - * Wound infection, hematoma/bleeding, pneumonia, intra peritoneal adhesions, small bowel obstruction, tubal infertility, colonic fistula, intra abdominal abscess, incisional hernias

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SURGERY VS ANTIBIOTICS:

- * The costs of surgery
- * The risks of surgery
- * **Does antibiotic therapy work?**

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IS THERE ANY LITERATURE?

“Treated in a purely medical or tentative manner, the great majority of patients with appendicitis recover.”



Alfred Stengel (1868-1939)

Modern Medicine, Volume V: Diseases of the Alimentary Tract

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VS



- * Malik and Baris, J Gastrointest Surg 2009
 - * Significantly reduced need for analgesics
 - * 10% of NOM patients relapsed at 12 months

- * Varadham et al, World J Surg 2010
 - * MA of RCT of abx vs surgery showed 68% success rates with Abx alone (15% recurrence)

- * Lui and Fogg, Surgery 2012
 - * 1201 patients, failure rate of 6.9% \pm 4.4% and recurrence of 14.2% \pm 10.6%

ANTIBIOTICS ALONE FOR APPENDICITIS

Randomized clinical trial

Randomized clinical trial of antibiotic therapy *versus* appendicectomy as primary treatment of acute appendicitis in unselected patients

J. Hansson¹, U. Körner¹, A. Khorram-Manesh³, A. Solberg² and K. Lundholm¹

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Randomized clinical trial

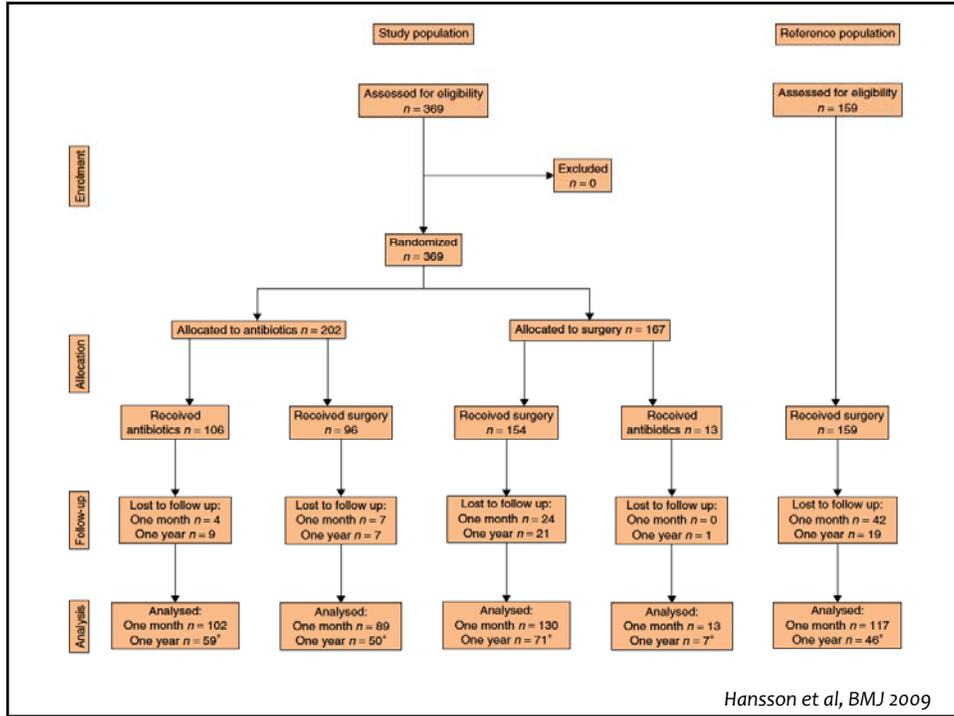
Randomized clinical trial of antibiotic therapy *versus* appendicectomy as primary treatment of acute appendicitis in unselected patients

J. Hansson¹, U. Körner¹, A. Khorram-Manesh³, A. Solberg² and K. Lundholm¹

- * 369 patients allocated to study (antibiotics) or control (surgery) group.
- * Study patients received 24 hours of IV antibiotics, then were discharged home with oral antibiotics for 10 days
- * Control patients had a standard appendectomy
- * F/U was at 1 and 12 months
- * Primary end points: treatment efficacy and major complications

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Hansson et al, BMJ 2009



	Antibiotics ($n = 106$)	Surgery ($n = 96$)
Sex ratio (M : F)	52 : 54	51 : 45
Age (years)*	40(2)	35(2)
Previous abdominal surgery†	12 (11.3)	9 (9)
Suspicion of previous appendicitis†	6 (5.7)	12 (13)
Clinical variables		
C-reactive protein (mg/l)*	51(6)	59(6)
White cell count ($\times 10^9/l$)*	12.4(0.4)	12.9(0.4)
Temperature ($^{\circ}C$)*	37.2(0.1)‡	37.5(0.1)
Local peritonitis†	16 (15.1)	19 (20)
General peritonitis†	3 (2.8)	6 (6)
Diagnostic variables†		
Radiological imaging (CT/US)	33 (31.1)	23 (24)
Gynaecological examination	70 (66.0)	68 (71)

Hansson et al, BMJ 2009

STUDY RESULTS

	Intention to treat		Per protocol		Reference group (n = 159)
	Antibiotics (n = 202)	Surgery (n = 167)	Antibiotics (n = 119)	Surgery (n = 250)	
Treatment efficacy					
Primary hospital stay	97 (48.0)*	142 (85.0)	108 (90.8)†	223 (89.2)	142 (89.3)
At 1 year	83 (41.1)*	142 (85.0)	93 (78.2)*	223 (89.2)	142 (89.3)
Recurrences	14*	1	15*	0	0
Appendectomy	11	1	12		
Second antibiotic treatment	3		3		

Hansson et al, BMJ 2009

	Intention to treat		Per protocol		Reference group (n = 159)
	Antibiotics (n = 202)	Surgery (n = 167)	Antibiotics (n = 119)	Surgery (n = 250)	
Reoperation	1*	5†	1*	5†	1‡
Abscesses	5	5	1	9	3
Small bowel obstruction		4		4	2
Wound rupture	1	2		3	1
Wound hernia		1		1	1
Pulmonary embolism		1		1	
Postoperative cardiac problems		1		3	
Aspiration at extubation					1
Ileocaecal resection	2	2	1	3	1
Caval vein thrombosis					1
Total	11 (5.4)¶	18 (10.8)	3 (2.5)¶	25 (10.0)	11 (6.9)

	Intention to treat		Per protocol		Reference group (n = 159)
	Antibiotics (n = 202)	Surgery (n = 167)	Antibiotics (n = 119)	Surgery (n = 250)	
Primary hospital stay (days)	3(0-1)	3(0-3)	2(0-1)	3(0-2)	2(0-1)
Sick leave (days)	7(1)*	11(1)	5(1)*	10(1)	10(1)
Total cost for primary hospital admission (SEK)	20 900(1200)*	30 400(3300)	18 000(1100)*	30 900(2300)	

Hansson et al, BMJ 2009

MORE EVIDENCE...

The NOTA Study (Non Operative Treatment for Acute Appendicitis)

Prospective Study on the Efficacy and Safety of Antibiotics (Amoxicillin and Clavulanic Acid) for Treating Patients With Right Lower Quadrant Abdominal Pain and Long-Term Follow-up of Conservatively Treated Suspected Appendicitis

Salomone Di Saverio, MD, Andrea Sibilio, MD,* Eleonora Giorgini, MD,* Andrea Biscardi, MD,*
Silvia Villani, MD,* Federico Coccolini, MD,† Nazareno Smerieri, MD,* Michele Pisano, MD,†
Luca Ansaloni, MD,† Massimo Sartelli,‡ Fausto Catena, MD, PhD, FRCS,§ and Gregorio Tugnoli, MD**

MAIN STUDY OUTCOMES

1. Determine the short term efficacy of antibiotic treatment
2. Long-term efficacy of antibiotic treatment and incidences of recurrent episodes with 2 year follow up
3. Long-term efficacy of antibiotic treatment and no need for surgery during follow up period
4. Safety of antibiotic treatment

Saverio et al. *Annals of Surgery* 2014

SECONDARY OUTCOMES

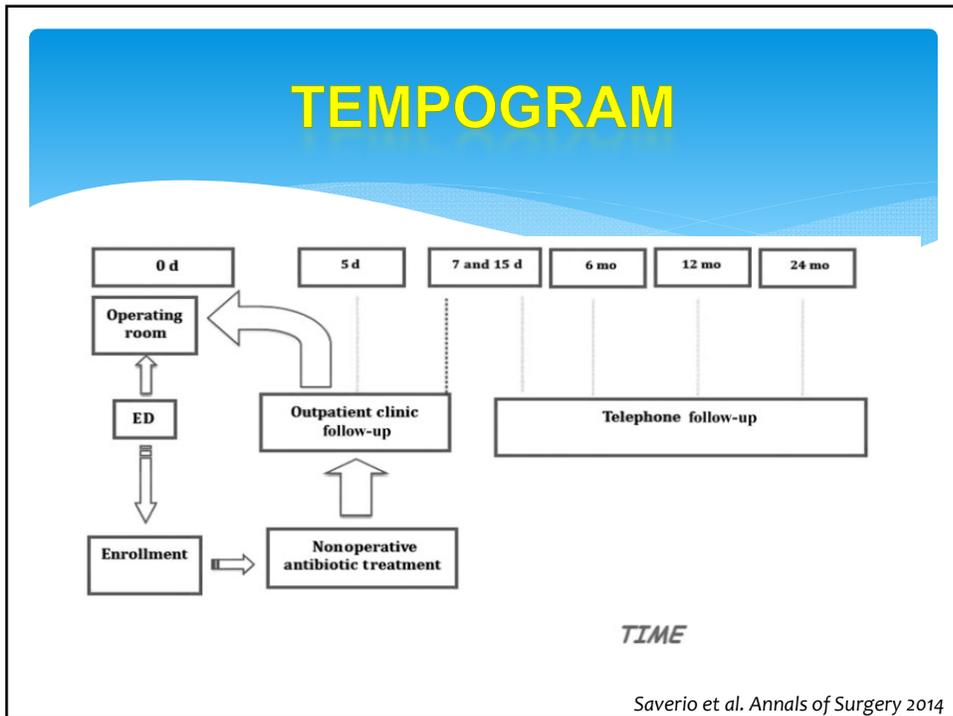
1. Antibiotic side effects
2. Abdominal pain after discharge based on Numeric Rating Scale
3. Length of hospital stay
4. Number of outpatient office visits
5. Number of sick leave days
6. Cost analysis

STUDY DESIGN

- * Single-prospective observational study
- * Study following 159 patients
- * Appendicitis Inflammatory Response and Alvarado Scores
- * Antibiotic treatment: Amoxicillin and Clavulanic Acid for 7 days
- * Follow up period (7 days, 15 days, 6mo, 1yr, 2 years)

Inclusion Criteria	Exclusion Criteria
Age >14 yr Right lower abdominal pain/RIF pain Clinical diagnosis/suspicion made by attending surgeon of acute appendicitis (Alvarado score >5 and <10 and/or AIR score >2 and <11) Informed consent	Diffuse peritonitis Penicillin allergy Previously already started antibiotic therapy Previous appendectomy Positive pregnancy test IBD history or suspicion of IBD recurrence


Saverio et al. *Annals of Surgery* 2014



Characteristics of included patients	
Male vs female	41 vs 118
US done	116 (73%)
US positive*	88 (76%)
CT scan done	27 (17%)
CT scan positive (NPA†)	21 (78%)
Clinical diagnosis <i>only</i> of acute appendicitis	16 (10%)
Alvarado score 5–6 (62 patients)	40.2%
Alvarado score 7–8 (81 patients)	51%
Alvarado score 9 (14 patients)	8.8%
AIR score 3–4 (61 patients)	38.3%
AIR score 5–8 (80 patients)	50.3%
AIR score 9–10 (18 patients)	11.3%
Minor side effects (eg, bloating, diarrhea, flatulence, nausea, or vomiting)	11.9%
Results	
Long-term efficacy after 1 yr	83%
Long-term efficacy after 2 yr	83%
Abdominal pain at 5 d (median NRS score)	3
Abdominal pain at 5 d (median NRS score)	2
Abdominal pain at 5 d (mean VAS score)	1.3
Length of hospital stay‡	0.4
Sick leave period‡	5.8
No. follow-up (outpatient) appointments‡	1.3

Saverio et al. *Annals of Surgery* 2014

RESULTS: 7 DAY TO 2 YEAR FOLLOW UP

Time	7 d	15 d	6 mo	1 yr	2 yr
Rate	11.9%*	0%	10.7%	12.6%	13.8%
No. patients	19/159 failures	0/159 recurrences	17/159 recurrences	20/159 recurrences	22/159 recurrences
Therapy	19 O.R. <7 d‡	—	7/17 O.R. 10/17 NOM	8/20 O.R. 12/20 NOM	8/22 O.R. 14/22 NOM

- * Early recurrence (~ 12%) – underwent appendectomy
- * No early recurrences at 15 days
- * 17 recurrences at 6 mo; 59% treated NOM
- * Only 3 additional recurrences at 1 yr
- * Majority of recurrence at 2 years treated NOM

Saverio et al. *Annals of Surgery* 2014

UNIVARIATE AND MULTIVARIATE ANALYSIS OF PROGNOSTIC FACTORS PREDICTIVE OF NOM FAILURE

	Univariate Analysis, <i>P</i>	Multivariate Analysis, <i>P</i>
Vomiting	0.515	ns
Nausea or vomiting	0.423	ns
Anorexia	0.652	ns
Pain in RLQ	0.098	ns
Migration of pain to the RLQ	0.125	ns
Rebound tenderness/muscular defense	0.076	ns
Body temperature	0.085	ns
Leukocytosis shift	0.152	ns
Polymorphonuclear leukocytes	0.058	ns
White blood cell $>10 \times 10^9 /L$	0.239	ns
C-reactive protein	0.071	ns
Sex	0.186	ns
Age	0.240	ns
Alvarado score	0.003	<0.05
AIR (Andersson) score	0.001	<0.01

Saverio et al. Annals of Surgery 2014

COST ANALYSIS OF NOM PER PATIENT



Overall costs	€316.20/\$394.10
Antibiotics	€14.80/\$18.45
LOS	€180/\$224.34
Outpatient follow-up	€4.20/\$5.23
Sick leave days	€117.20/\$146.07

Saverio et al. Annals of Surgery 2014

CONCLUSIONS

- * Antibiotics alone appears safe and efficacious
- * While RCT are needed, antibiotic therapy as first line treatment of acute appendicitis appears safe
- * Compared to surgery, antibiotic therapy is cost effective and affordable

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THANK YOU!

