Improving People's Lives Through Innovations in Personalized Health Care

Surgical Site Infection Prevention

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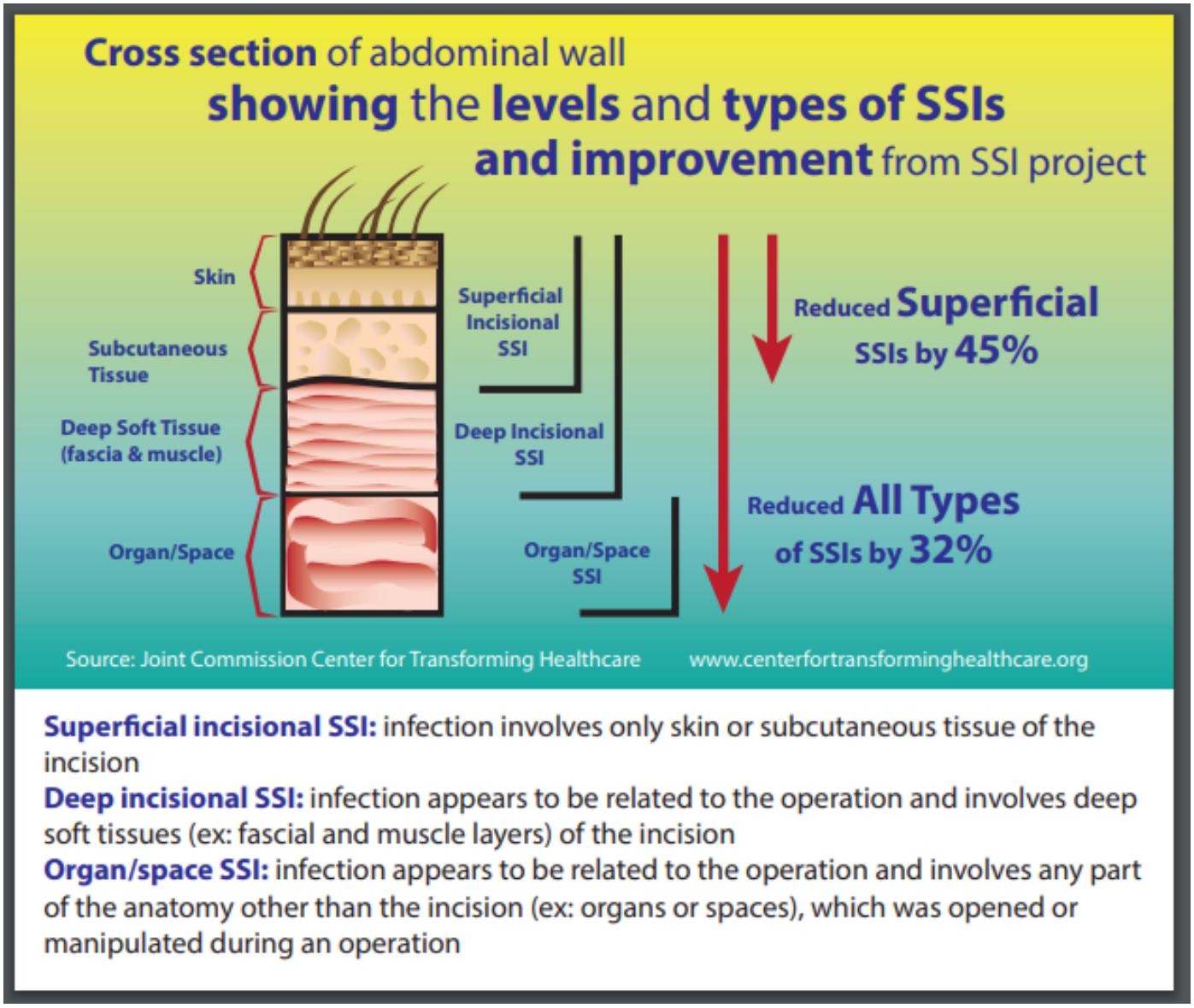
THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

Nothing to Disclose

Surgical Site Infection (SSI)

- 2-5% of surgical patients experience SSI
- Estimated 500,000 SSI / yr
- Upto $10 Billion / yr
- $3000-29000 / SSI
- Significant morbidity
  - 2-11 times higher risk of death
  - 7-10 additional hospital days

Klevens RM, Edwards JR, et al: Estimating health care-associated infections and deaths in U.S. hospitals, 2002, Public Health Reports 2007;122:160-166



Source: www.centerfortransforminghealthcare.org

Risk Factors for SSI

- Smoking
- Age
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach

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- Well established risk factor[1]
  - Superficial: OR: 1.3
  - Deep: OR: 1.4
  - Organ Space: OR: 1.38
- Mediators:
  - Nicotine
  - CO
  - Hydrogen Cyanide
  - Formaldehyde

1. Turan A, Mascha EJ, Roberman D, et al. Smoking and perioperative outcomes. *Anesthesiology*. 2011;114(4):837-846. doi:10.1097/ALN.0b013e318210f560

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- Immune Dysfunction
- Surgical approach

- Aging associated skin changes[1]:
  - ↓ overall thickness
  - ↓ Langerhans cells (immunity)
  - ↓ number and function of fibroblasts
  - ↓ collagen production
  - ↓ dermal regeneration and repair

- Increased SSI?

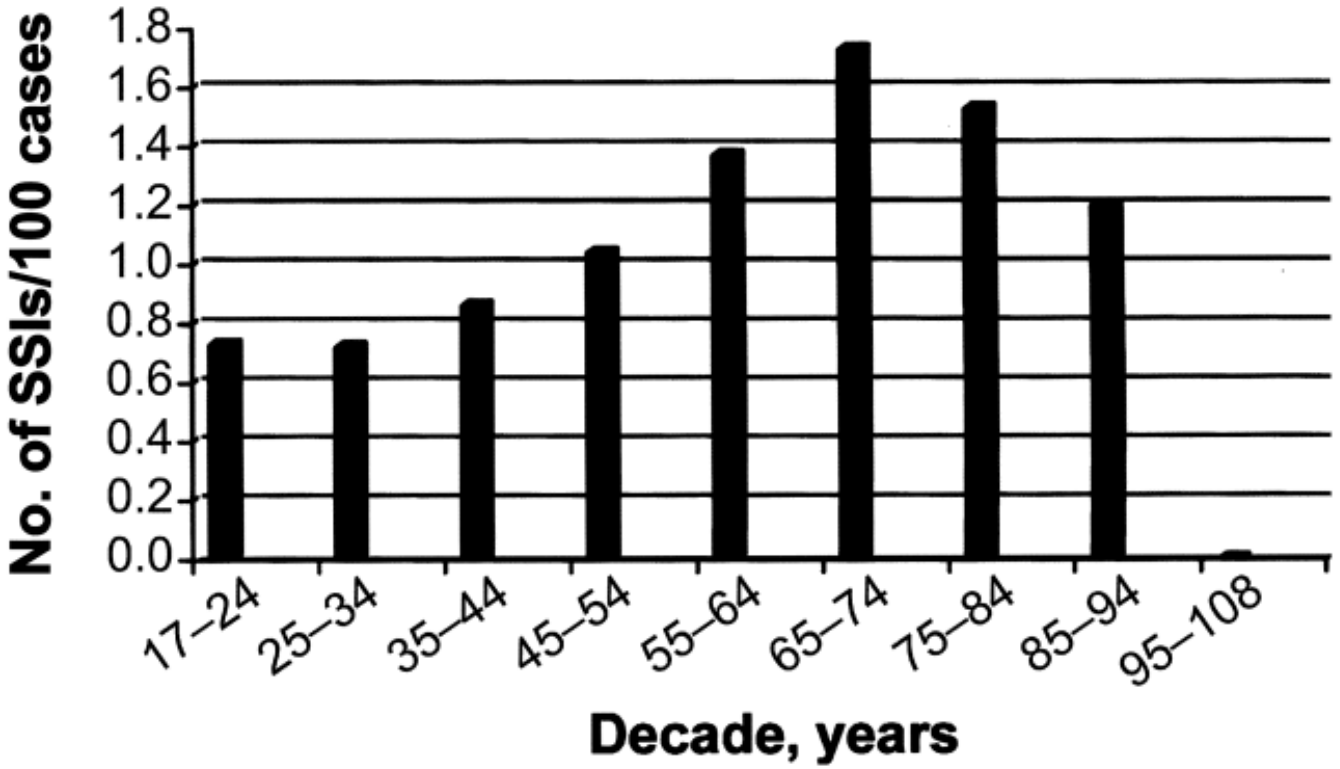
1. Fore J. A review of skin and the effects of aging on skin structure and function. *Ostomy Wound Manage*. 2006;52(9):24-37.

The Effect of Increasing Age on the Risk of Surgical Site Infection

The Journal of Infectious Diseases 2005; 191:1056–62

Keith S. Kaye,[1,3,4] Kristine Schmit,[2] Carl Pieper,[4] Richard Sloane,[4] Kathleen F. Caughlan,[3] Daniel J. Sexton,[1,3] and Kenneth E. Schmader[4,5]

Divisions of [1]Infectious Diseases and [2]Geriatrics, Department of Medicine, School of Medicine, and [3]Duke Infection Control Outreach Network, and [4]Center for the Study of Aging and Human Development, Duke University Medical Center, and [5]Geriatric Research, Education, and Clinical Center, Durham Veterans Affairs Medical Center, Durham, North Carolina



Risk Factors for SSI

- Smoking
- Age
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach

- No universally accepted definition
  - ↓ Body weight
  - Weight loss
  - ↓ Albumin
  - ↓ Prealbumin

- Hypoalbuminemia is an independent risk factor[1]

1. Hennessey DB, Burke JP, Ni-Dhonochu T, Shields C, Winter DC, Mealy K. Preoperative hypoalbuminemia is an independent risk factor for the development of surgical site infection following gastrointestinal surgery: a multi-institutional study. *Ann Surg*. 2010;252(2):325-329. doi:10.1097/SLA.0b013e3181e9819a

Risk Factors for SSI

- Smoking
- Age?
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach

- Multifactorial[1]
  - Hyperglycemia
  - Chronic inflammation
  - Micro and macro-circulatory dysfunction
  - Hypoxia
  - Autonomic and sensory neuropathy
  - Impaired neuropeptide signaling

1. Baltzis D, Eleftheriadou I, Veves A. Pathogenesis and treatment of impaired wound healing in diabetes mellitus: new insights. *Adv Ther*. 2014;31(8):817-836. doi:10.1007/s12325-014-0140-x

Risk Factors for SSI

- Smoking
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- Surgical approach

Table 1

Pooled estimates of the association between diabetes and SSI by surgery type

Surgery Type	Number of Studies	Pooled Estimate	95% Prediction Interval	I^2, %
Gynecological	6	1.61	(1.15, 2.24)	4.0
Colorectal	7	1.16	(0.93, 1.44)	9.5
Arthroplasty	6	1.26	(1.01, 1.66)	11.7
Breast	5	1.58	(0.91, 2.72)	2.7
Cardiac	15	2.03	(1.13, 4.05)	22.4
Spinal	14	1.66	(1.10, 2.32)	8.1
Other/Multiple Surgery types combined	37	1.46	(1.07, 2.00)	41.5

Martin ET, Kaye KS, Knott C, et al. Diabetes and Risk of Surgical Site Infection: A Systematic Review and Meta-analysis. Infect Control Hosp Epidemiol. 2016;37(1):88-99. doi:10.1017/ice.2015.249

Risk Factors for SSI

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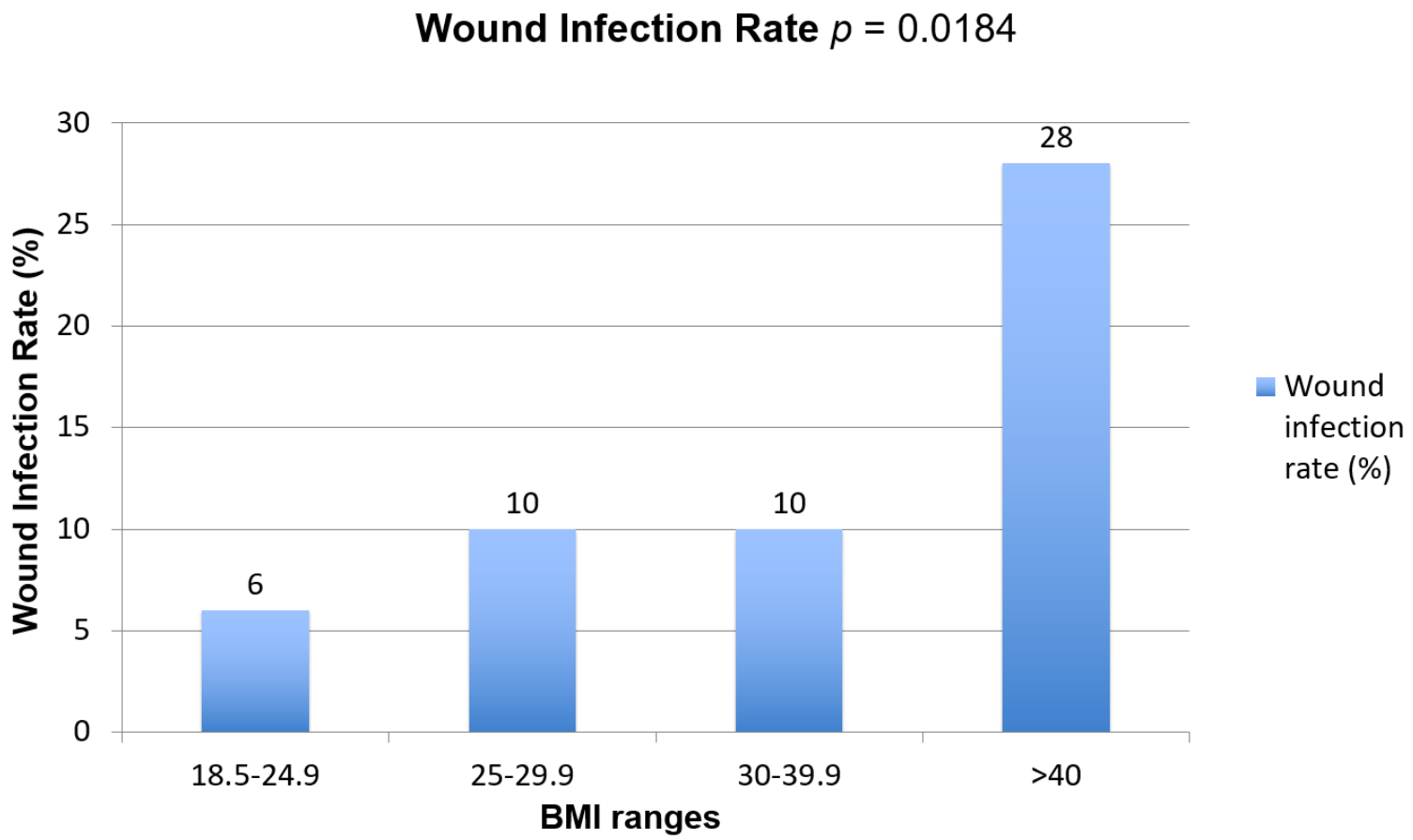
- Surgical approach

- Multifactorial[1]:
  - Inherent anatomic features of adipose tissue
  - Vascular insufficiencies
  - Cellular and composition modifications
  - Oxidative stress
  - Alterations in immune mediators
  - Nutritional deficiencies

1. Pierpont YN, Dinh TP, Salas RE, et al. Obesity and surgical wound healing: a current review. *ISRN Obes*. 2014;2014:638936. Published 2014 Feb 20. doi:10.1155/2014/638936

BMI and SSI in Colorectal Surgery – OSU Data



Impact of Obesity on Short-term Outcomes after Laparoscopic Colorectal Resections: A Multivariate Analysis. Tuthill S, Harzman A, Arnold M, Husain S. American Society of Colon and Rectal Surgeons 2015 Annual meeting. May 30 - June 3, Boston, MA.

Risk Factors for SSI

- Smoking
- Age?
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach

- Arterial and venous vascular insufficiency associated with poor wound healing

Risk Factors for SSI

- Smoking
- Age?
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach

- Chemotherapy
  - EGFR (Cetuximab)
  - VEGF (Bevacizumab)
- Steroids
- Radiation
- At risk:
  - Transplant
  - Cancer
  - Inflammatory Bowel Disease

Risk Factors for SSI

- Smoking
- Age?
- Poor Nutrition
- Diabetes
- Obesity
- Vascular Disease
- Immune Dysfunction
- Surgical approach
  - Emergency vs Elective
  - MIS vs Open
  - Extraction site

SSI Prevention

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

Pre-operative Interventions

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- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Smoking Cessation Clinic referral

REVIEW ARTICLE

Wound Healing and Infection in Surgery

The Clinical Impact of Smoking and Smoking Cessation: A Systematic Review and Meta-analysis

Lars Tue Sørensen, MD

ARCH SURG/VOL 147 (NO. 4), APR 2012 WWW.ARCHSURG.COM

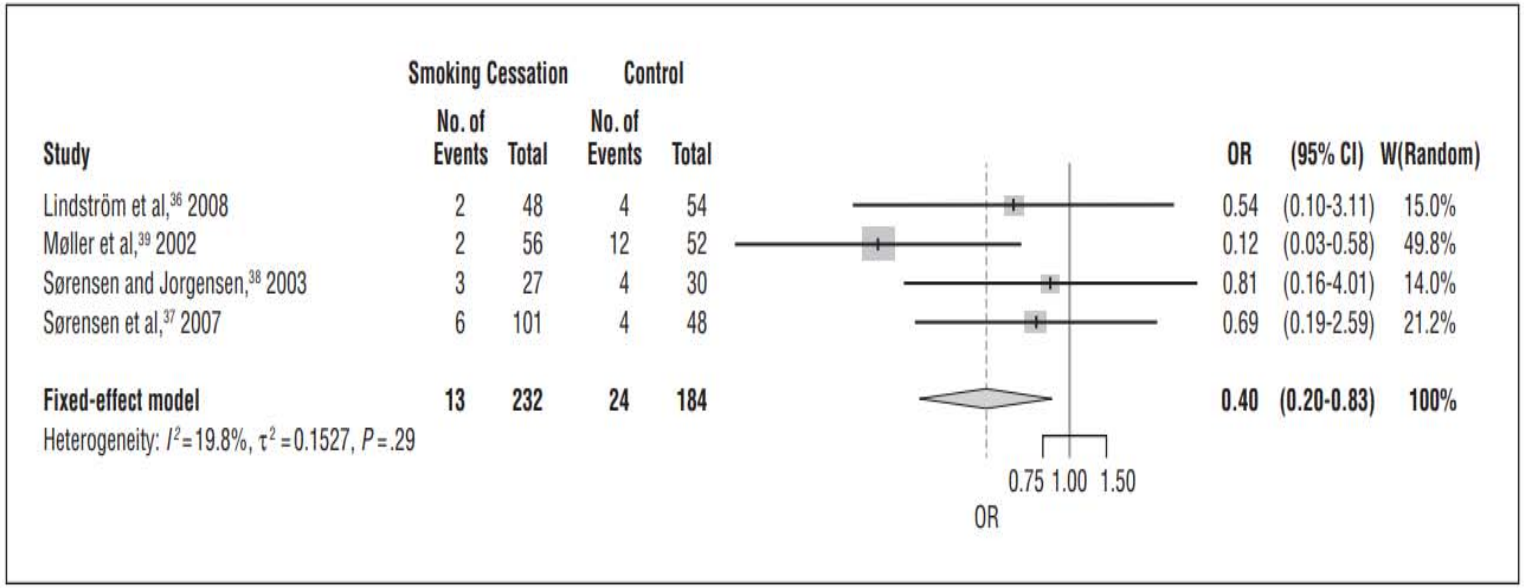


Figure 3. Meta-analysis (sensitivity analysis) of the effect of perioperative smoking cessation intervention on surgical site infection. The size of the data marker corresponds to the relative weight assigned in the pooled analysis using fixed-effects models. OR indicates odds ratio; W, weighted.

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Smoking Cessation Clinic referral
- Pharmacologic adjuncts
  - Varenicline tartrate (Chantix)
  - Buproprion hydrochloride (Zyban)
- Nicotine replacement

Abstinence From Smoking Reduces Incisional Wound Infection:

A Randomized Controlled Trial

Annals of Surgery • Volume 238, Number 1, July 2003

Lars Tue Sorensen, MD,† Tonny Karlsmark, MD, DMSci,* and Finn Gottrup, MD, DMSci**

- 48 smokers and 30 non smokers
- Smokers randomized:
  - Continuous smoking
  - Abstinence with transdermal nicotine
  - Abstinence with placebo patch
- Results (SSI Rates):
  - Non Smokers: 2%
  - Smokers: 12%
    - Continuous Smoking: 22%
    - Abstinent: 1.1%
- Nicotine did not have any deleterious effect on SSI

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Diet & exercise
- Pharmacologic adjuncts
  - Orlistat (Xenical, Alli)
  - Lorcaserin (Belviq),
  - Phentermine-topiramate (Qsymia)
  - Naltrexone-bupropion (Contrave)
  - liraglutide (Saxenda)
  - GLP-1 Agonists
- Surgical weight loss?

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Nutritionist consultation
- Enteral supplements
  - Tube feeds
- Preoperative TPN
- Should surgery be delayed in severe malnutrition?
- Immunonutrition?
  - Glutamine
  - Arginine

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- American Diabetes Association Recommendations[1]:
  - HbA1c levels on all patients with > 140 mg/dl
  - Target glucose range: 80–180 mg/dl (4.4–10.0 mmol/L).
  - Withhold oral hypoglycemic agents the morning of surgery
  - Give half of NPH dose or 60–80% doses of a long-acting analog or pump basal insulin
  - Monitor blood glucose at least every 4–6 h while NPO and dose with short-acting insulin as needed

1. American Diabetes Association. 14. Diabetes Care in the Hospital: *Standards of Medical Care in Diabetes-2018*. *Diabetes Care*. 2018;41(Suppl 1):S144-S151. doi:10.2337/dc18-S014

Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Mechanical bowel prep reduces infections in colorectal procedures
- No clear role in non colorectal procedures

Pre-operative Interventions

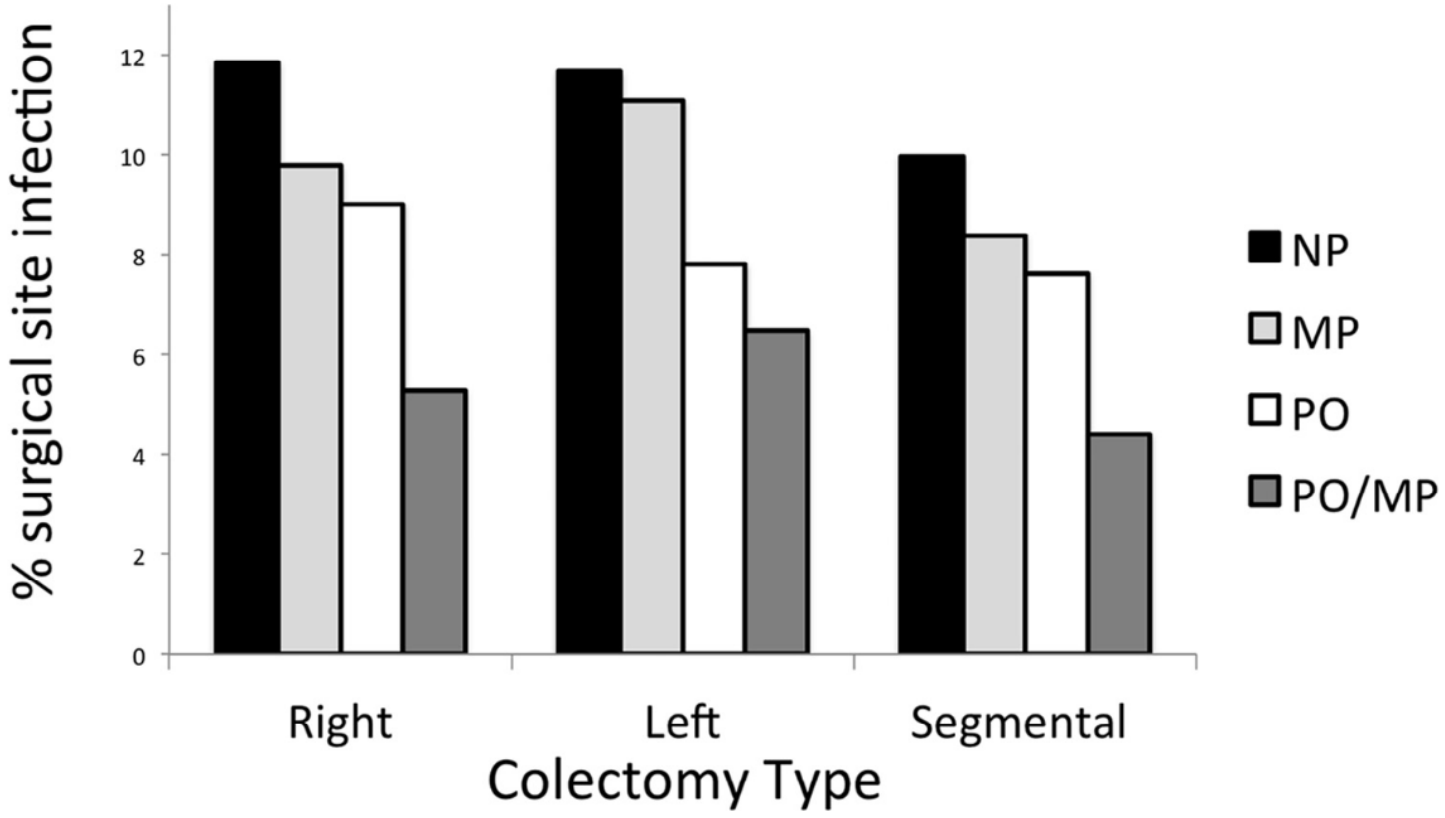
- Smoking Cessation
- Weight Reduction
- Nutritional Optimization
- Glycemic Control
- Bowel Prep
- Antibiotics
  - Oral Antibiotic prep
    - Neomycin + Erythromycin
    - Neomycin + Metronidazole
  - Parenteral Antibiotic prophylaxis
    - High risk procedures
    - Within one hour before incision
    - Cefazolin for most general surgical procedures
    - Cefoxitin + Metronidazole or Ertapenem for colorectal procedures
    - Redose for procedures that extend 2.5 half life or for every 1500ml of blood loss
    - Discontinue after the procedure
- Skin Prep / Draping

Combination oral and mechanical bowel preparations decreases complications in both right and left colectomy

Emily F. Midura [a,b], Andrew D. Jung [a,b], Dennis J. Hanseman [a,b], Vikrom Dhar [a,b], Shimul A. Shah [a,b], Janice F. Rafferty [a], Bradley R. Davis [c], and Ian M. Paquette [a,b,*]

[a] *Department of Surgery, University of Cincinnati School of Medicine, Cincinnati, OH*
[b] *Cincinnati Research in Outcomes and Safety in Surgery (CROSS), Cincinnati, OH*
[c] *Carolinas Medical Center, Charlotte, NC*

Surgery 163 (2018) 528–534



Pre-operative Interventions

- Smoking Cessation
- Weight Reduction
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- Glycemic Control
- Bowel Prep
- Antibiotics
- Skin Prep / Draping

- Preop Chlorhexidine bathing?
- Chlorhexidine impregnated cloths
- Hair Clipping (not shaving)
- Skin prep: Alcohol > Chlorhexidine > Iodine

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique

- Intraoperative glucose monitoring q1-2 hrs
- Short acting insulin
- Electrolyte monitoring
- May need infusion for long cases

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique

- Intra-op hypothermia associated with SSI, OR:1.6[1]
- Warming blankets
- Fluid warmers

1. Bu N, Zhao E, Gao Y, et al. Association between perioperative hypothermia and surgical site infection: A meta-analysis. Medicine (Baltimore). 2019;98(6):e14392. doi:10.1097/MD.0000000000014392

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique

- Sterile Technique:
  - Minimize / contain contamination
  - Obliterate dead space
- Irrigation?

Intra-operative wound irrigation to reduce surgical site infections after abdominal surgery: a systematic review and meta-analysis

Tara C. Mueller · Martin Loos · Bernhard Haller · André L. Mihaljevic · Ulrich Nitsche · Dirk Wilhelm · Helmut Friess · Jörg Kleeff · Franz G. Bader

Langenbecks Arch Surg (2015) 400:167–181

Study or Subgroup	Any Irrigation Events	Total	No Irrigation Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Mountain 1970	7	76	18	74	3.1%	0.32 [0.12, 0.81]	1970
Madsen 1971	0	32	8	32	0.7%	0.04 [0.00, 0.81]	1971
Longland 1971	10	100	38	200	3.7%	0.47 [0.23, 1.00]	1971
Andersen, Korner 1972	3	120	22	120	2.3%	0.11 [0.03, 0.39]	1972
Andersen, Bendtsen 1972	10	245	42	245	3.7%	0.21 [0.10, 0.42]	1972
Mackie 1973	4	69	2	23	1.5%	0.65 [0.11, 3.78]	1973
Gilmore, Martin 1974	26	199	24	151	4.1%	0.80 [0.44, 1.45]	1974
Bates 1974	3	100	16	100	2.3%	0.16 [0.05, 0.58]	1974
Gilmore, Sanderson 1975	6	63	18	70	2.9%	0.30 [0.11, 0.82]	1975
Jensen 1975	10	184	6	83	2.8%	0.74 [0.26, 2.10]	1975
McCluskey 1976	21	56	14	54	3.4%	1.71 [0.76, 3.87]	1976
Galland 1977	14	39	18	39	3.2%	0.65 [0.26, 1.62]	1977
Stokes 1977	11	55	21	62	3.3%	0.49 [0.21, 1.14]	1977
Tanphiphat 1978	4	122	12	124	2.5%	0.32 [0.10, 1.01]	1978
Barr 1978	1	28	23	60	1.2%	0.06 [0.01, 0.47]	1978
Andersen, Burcharth 1980	5	196	7	102	2.5%	0.36 [0.11, 1.15]	1980
Kothuis 1981	16	102	15	118	3.6%	1.28 [0.60, 2.73]	1981
Gray 1981	7	71	20	82	3.1%	0.34 [0.13, 0.86]	1981
Walsh 1981	28	308	40	319	4.4%	0.70 [0.42, 1.16]	1981
Ostergaard 1981	3	120	22	120	2.3%	0.11 [0.03, 0.39]	1981
Foster 1981	29	119	27	117	4.1%	1.07 [0.59, 1.96]	1981
de Jong 1982	39	303	45	279	4.5%	0.77 [0.48, 1.22]	1982
Galland 1983	13	95	14	105	3.4%	1.03 [0.46, 2.32]	1983
Sherlock 1984	6	39	13	36	2.6%	0.32 [0.11, 0.97]	1984
Sood 1984	0	29	4	26	0.6%	0.08 [0.00, 1.66]	1984
Juul 1985	5	105	5	98	2.3%	0.93 [0.26, 3.32]	1985
Lau 1986	9	159	3	156	2.2%	3.06 [0.81, 11.52]	1986
Moesgaard, Nielsen 1988	24	41	22	38	3.2%	1.03 [0.42, 2.51]	1988
Raahave 1989	5	81	6	89	2.4%	0.91 [0.27, 3.10]	1989
Seco 1989	5	126	15	120	2.8%	0.29 [0.10, 0.82]	1989
Moesgaard et al. 1989	15	87	14	90	3.5%	1.13 [0.51, 2.51]	1989
Cervantes-Sanchez 2000	11	127	39	156	3.7%	0.28 [0.14, 0.58]	2000
Al-Ramahi 2006	11	104	10	102	3.2%	1.09 [0.44, 2.69]	2006
Pradhan 2009	1	35	6	35	1.1%	0.14 [0.02, 1.25]	2009
Güngördük 2012	17	260	19	260	3.9%	0.89 [0.45, 1.75]	2012
Total (95% CI)		**3995**		**3885**	**100.0%**	**0.54 [0.42, 0.69]**	
Total events	379		628				

Heterogeneity: Tau² = 0.31; Chi² = 85.15, df = 34 (P < 0.00001); I² = 60%
Test for overall effect: Z = 4.86 (P < 0.00001)

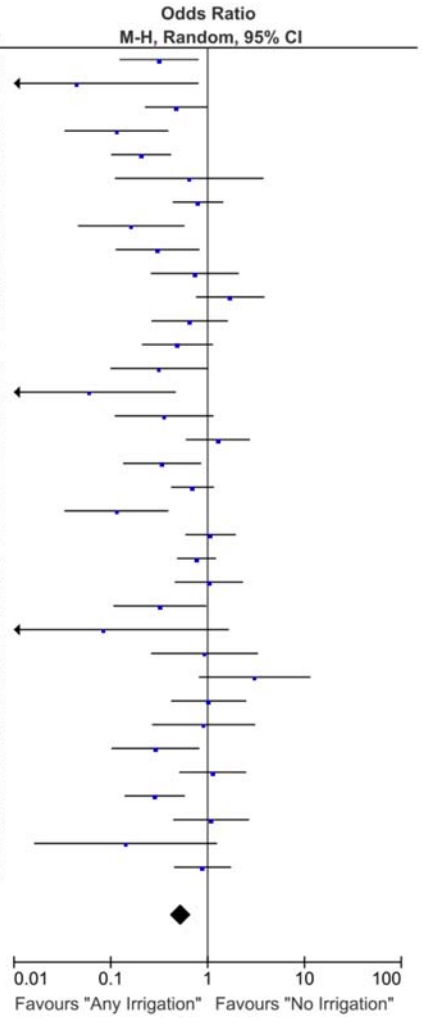


Fig. 2 Forest plot of IOWI with any irrigation solution vs. no irrigation (group A). Individual and pooled effect estimates for all 35 included studies are shown

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique

- GI procedures
- Randomized data

Barrier Wound Protection Decreases Surgical Site Infection in Open Elective Colorectal Surgery: A Randomized Clinical Trial

Dis Colon Rectum 2010; 53: 1374–1380

Kate Reid, B.Med.[1] • Peter Pockney, D.M., F.R.C.S.[2]
Brian Draganic, B.Med., F.R.A.C.S.[3] • Stephen R. Smith, M.S., F.R.A.C.S.[3]

1 Canberra Hospital, Canberra City, Australian Capital Territory, Australia
2 Department of GI Surgery, Imperial College Healthcare Trust, London, United Kingdom
3 Division of Surgery, John Hunter Hospital, University of Newcastle, Newcastle, New South Wales, Australia

TABLE 3. Results

	Control (n = 66)	*Intervention (n = 64)*	*P*
SSI: as per CDC guidelines, n (%)	15 (22.73)	3 (4.69)	.004
Reoperation for SSI	1	0	1.000
Readmissions for SSI	3	2	1.000
Formal wound drainage for SSI	3	1	.619
Purulent wound drainage	12	2	.009
Intravenous antibiotic (no. of courses used to treat SSI)	10	3	.077
Oral antibiotics (no. of courses used to treat SSI)	10	3	.077
Total length of stay: mean days (SD)	12.3 (6.2)	13.7 (14.1)	.463

SSI = surgical site infection; CDC = Centers for Disease Control and Prevention.

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique
  - Minimally invasive approach

Lap vs Open Colectomies – OSU Data

	Laparoscopic n=1,008		Open n=610		p-value
Surgical Site Infection	**126**	**12.50%**	**110**	**18.03%**	**0.002**
Deep Incisional SSI	33	3.27%	40	6.56%	0.002
Superficial Incisional SSI	13	1.29%	17	2.79%	0.031
Organ Space SSI	83	8.23%	59	9.67%	0.322

Original Investigation | Infectious Diseases

JAMA Network Open. 2019;2(10):e1913570.

Association of Open Approach vs Laparoscopic Approach With Risk of Surgical Site Infection After Colon Surgery

Daniel A. Caroff, MD, MPH; Christina Chan, MPH; Ken Kleinman, ScD; Michael S. Calderwood, MD, MPH; Robert Wolf, BTS; Elizabeth C. Wick, MD; Richard Platt, MD, MSc; Susan Huang, MD, MPH

Table 4. Population Attributable Fractions and Raw SSI Rates, Stratified by Surgical Approach (Laparoscopic or Open)

Procedure	No. (% Unadjusted SSI Rate)			PAF for Open Procedures, %
	Overall	Laparoscopic	Open	
Total, all 5 procedures combined	229 726 (6.2)	10 5144 (4.1)	124 585 (7.9)	34.2
Right hemicolectomy	121 065 (5.8)	55 871 (3.9)	65 194 (7.4)	33.4
Sigmoidectomy	65 759 (6.3)	30 541 (4.1)	35 218 (8.2)	34.4
Left hemicolectomy	21 572 (7.6)	8138 (5.1)	13 434 (9.1)	32.4
Other partial excision of large intestine	11 244 (6.4)	6772 (3.9)	4472 (10.2)	39.3
Resection of transverse colon	10 086 (6.2)	3822 (4.1)	6264 (7.5)	33.6

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique
  - Minimally invasive approach
    - Hand assist?
    - Extraction site

Impact of the extraction-site location on wound infections after laparoscopic colorectal resection

Cigdem Benlice, Luca Stocchi*, Ipek Sapci, Emre Gorgun, Hermann Kessler, David Liska, Scott R. Steele, Conor P. Delaney

Department of Colorectal Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, OH, USA

The American Journal of Surgery 217 (2019) 502–506

Table 2
Multivariate analysis of factors associated with the risk of extraction site surgical site infection.

Variable	Odds Ratio (95% CI)	P-value
BMI (per 5-Kg/m^2 increments)	1.2 (1.1–1.3)	<0.001
Extraction Site Locations		0.006
RLQ/LLQ[a]	1	
Infraumbilical midline	2.8 (1.4–5.5)	0.003
Midline (converted)	3.8 (1.9–7.6)	<0.001
Periumbilical midline	3.0 (1.5–6.0)	0.002
Pfannenstiel	2.6 (1.3–4.9)	0.004
Stoma site	1.1 (0.30–4.3)	0.84
Dissection/anastomosis above peritoneal reflection	2.9 (1.4–6.0)	0.005
Intraoperative adhesions	1.4 (1.03–1.8)	0.033
Surgical Procedure		0.020
Total abdominal colectomy[a]	1	
Left-sided colectomy	1.9 (1.05–3.5)	0.034
Right-sided colectomy	1.4 (0.79–2.5)	0.24
Proctectomy	2.2 (0.97–5.1)	0.059
Total proctocolectomy	3.2 (1.4–7.2)	0.005
Diagnosis		<0.001
Neoplasm[a]	1	
Crohn's disease	1.6 (1.04–2.5)	0.033
Diverticulitis	1.9 (1.2–3.1)	0.009
Ulcerative colitis	3.0 (1.6–5.4)	<0.001
Others[b]	1.2 (0.72–2.1)	0.44
Operative time (per 30-min increments)	1.04 (0.99–1.10)	0.099
Incision Length (per 1-cm increments)	1.02 (0.97–1.08)	0.40
Estimated blood loss (per 100-cc increments)	1.04 (0.98–1.1)	0.23

Surg Endosc (2013) 27:4574–4580
DOI 10.1007/s00464-013-3126-x

Multivariate analysis of risk factors for surgical site infection after laparoscopic colorectal surgery

Joseph Drosdeck · Alan Harzman · Andrew Suzo · Mark Arnold · Mahmoud Abdel-Rasoul · Syed Husain

Table 3 Multivariate logistic regression analysis for SSI

Variable	Odds Ratio	95 % CI	*p* value
IBD	3.32	1.45–7.56	0.004
BMI	1.07	1.02–1.11	0.002
Hand-assisted	2.25	1.02–4.97	0.045

IBD inflammatory bowel disease, *BMI* body mass index

Intra-operative Measures

- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique
  - Minimally invasive approach
    - Hand assist?
    - Extraction site
  - Closure protocol
    - Antibiotic impregnated sutures
    - Closure table
    - Dermabond

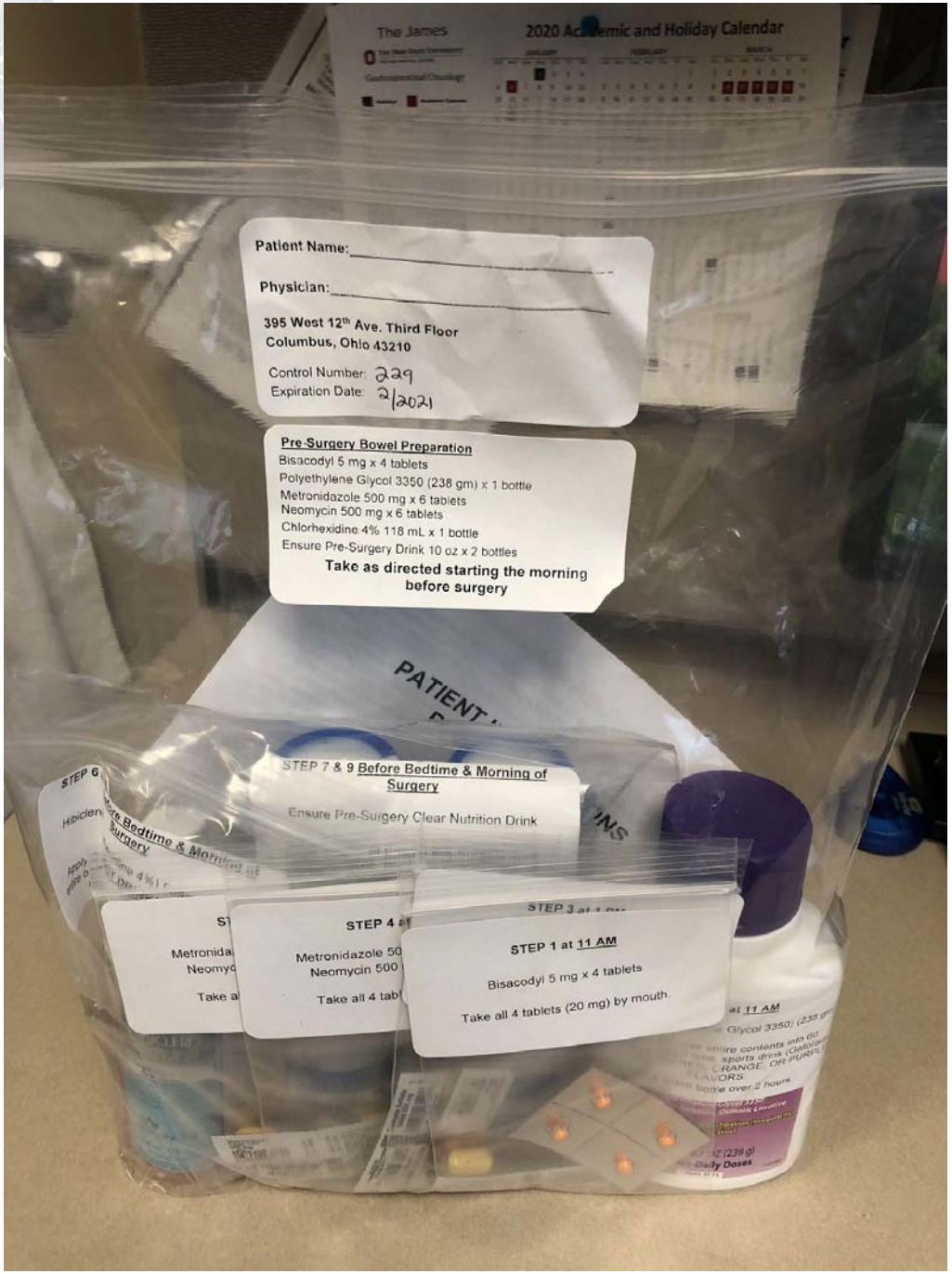
Intra-operative Measures

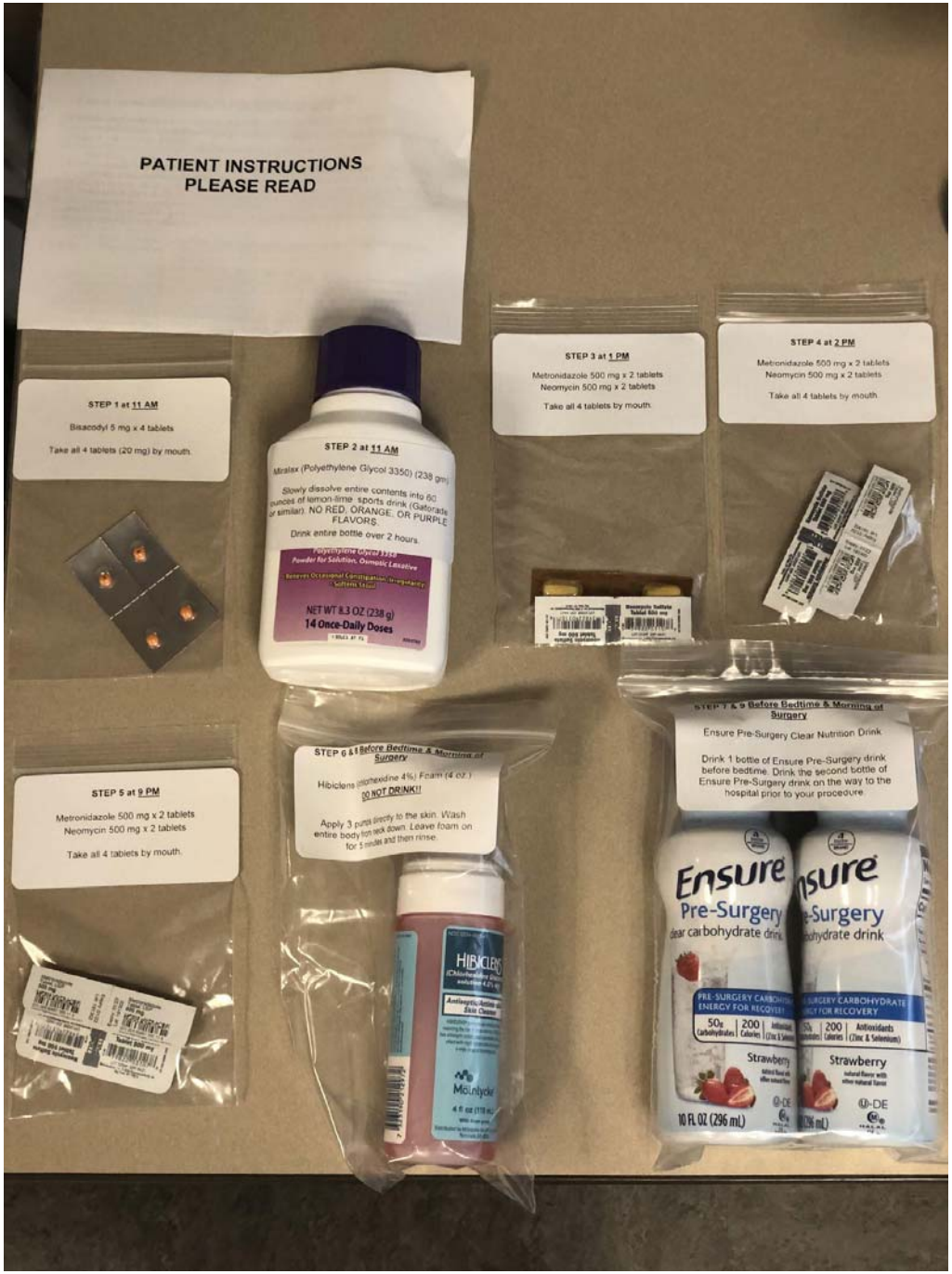
- Glycemic Control
- Normothermia
- Sterile Technique
- Wound Protectors
- Surgical Technique
- Incision Site
- Closure Protocol

Post-operative Care

- Surgical dressing removal
- Early showering
- Early ambulation
- Glycemic Control
- Topical antibiotics
- Wound vac

Role of ERAS Bundles





Compliance with preoperative care measures reduces surgical site infection after colorectal operation

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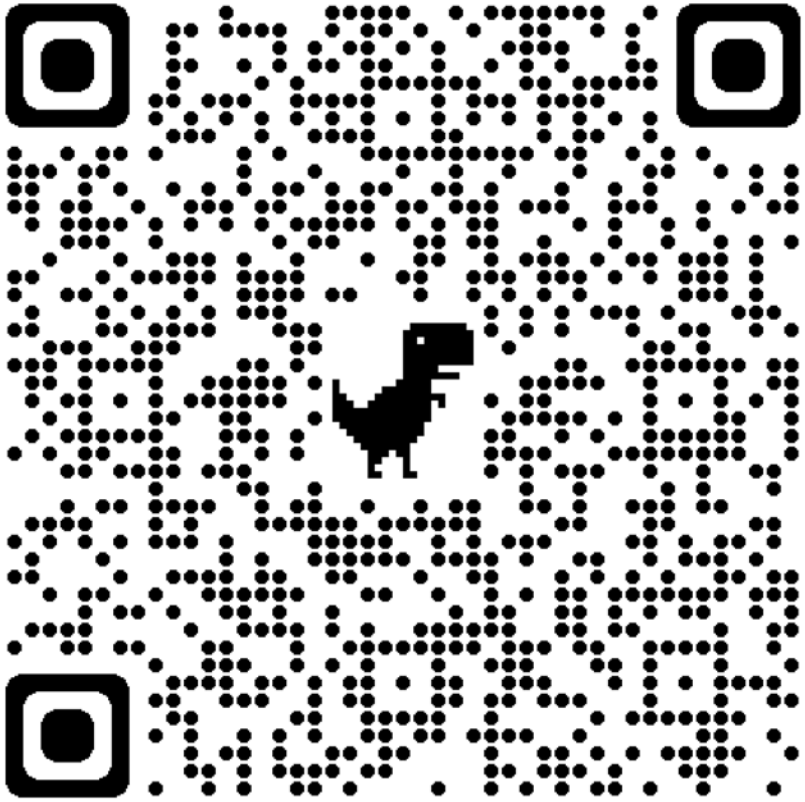
- Five Compliance measures
  - 1. Bowel preparation
  - 2. Preoperative Chlorhexidine wash / cloth
  - 3. Chloraprep skin prep
  - 4. Preoperative antibiotics
  - 5. Hair clipping
- SSI Rates:
  - 5/5 compliance: 5%
  - Less than full compliance:16%

Online Resources



Thank you!

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