

Skin Preparation and Technical Factors that May (or may not) Influence Infection Risk in Surgery

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**Should All Patients Bathe
with Chlorhexidine
Before Operation?**

Cochrane Systematic Review 2012

- 7 randomized control trials with a total of 10,157 participants
- Studies compared chlorhexidine 4% versus:
 - ✓ Bar soap
 - ✓ No bath or shower
- Also compared whole body CHG vs. localized washing
- One wash versus more than one wash
- Conclusion: no evidence that washing with CHG reduced the incidence of SSI

Possible issues

- **May need repeated applications (e.g., showering with CHG during the 3 days prior to surgery)**
- **Skin cleansing methods that avoid rinsing away of CHG may have the potential to be more effective**
- **This practice clearly lowers skin flora counts which cannot be bad, but has not been shown to reduce SSI**

Skin Prep

**Does the antiseptic used make
a difference?**

ORIGINAL ARTICLE

Effects of Preoperative Skin Preparation on Postoperative Wound Infection Rates: A Prospective Study of 3 Skin Preparation Protocols

Brian R. Swenson, MD, MS; Traci L. Hedrick, MD; Rosemarie Metzger, MD; Hugo Bonatti, MD;
Timothy L. Pruett, MD; Robert G. Sawyer, MD

OBJECTIVE. To compare the effects of different skin preparation solutions on surgical-site infection rates.

DESIGN. Three skin preparations were compared by means of a sequential implementation design. Each agent was adopted as the preferred modality for a 6-month period for all general surgery cases. Period 1 used a povidone-iodine scrub-paint combination (Betadine) with an isopropyl alcohol application between these steps, period 2 used 2% chlorhexidine and 70% isopropyl alcohol (ChloroPrep), and period 3 used iodine povacrylex in isopropyl alcohol (DuraPrep). Surgical-site infections were tracked for 30 days as part of ongoing data collection for the National Surgical Quality Improvement Project initiative. The primary outcome was the overall rate of surgical-site infection by 6-month period performed in an intent-to-treat manner.

SETTING. Single large academic medical center.

PATIENTS. All adult general surgery patients.

RESULTS. The study comprised 3,209 operations. The lowest infection rate was seen in period 3, with iodine povacrylex in isopropyl alcohol as the preferred preparation method (3.9%, compared with 6.4% for period 1 and 7.1% for period 2; $P = .002$). In subgroup analysis, no difference in outcomes was seen between patients prepared with povidone-iodine scrub-paint and those prepared with iodine povacrylex in isopropyl alcohol, but patients in both these groups had significantly lower surgical-site infection rates, compared with rates for patients prepared with 2% chlorhexidine and 70% isopropyl alcohol (4.8% vs 8.2%; $P = .001$).

CONCLUSIONS. Skin preparation solution is an important factor in the prevention of surgical-site infections. Iodophor-based compounds may be superior to chlorhexidine for this purpose in general surgery patients.

Povidone Iodine (& alcohol) v. Chlorhexidine (& alcohol) v. Iodine Povacrylex (& alcohol) Time Sequence Study

SSI	Number of SSI	Alcohol + Pov Iodine 1514	Alcohol + CHG 827	Alcohol + Iodine Povacrylex 794	P
Any	178 (5.7%)	72 (4.8%)	68 (8.2%)	38 (4.8%)	.001
Superficial	120 (3.8%)	49 (3.2%)	45 (5.4%)	26 (3.3%)	.019
Deep	11 (0.4%)	6 (0.4%)	4 (0.5%)	1 (0.1%)	.49
Organ/space	49 (1.6%)	18 (1.2%)	19 (2.3%)	12 (1.5%)	.12

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ORIGINAL ARTICLE

Chlorhexidine–Alcohol versus Povidone–Iodine for Surgical-Site Antisepsis

Rabih O. Darouiche, M.D., Matthew J. Wall, Jr., M.D., Kamal M.F. Itani, M.D.,
Mary F. Otterson, M.D., Alexandra L. Webb, M.D., Matthew M. Carrick, M.D.,
Harold J. Miller, M.D., Samir S. Awad, M.D., Cynthia T. Crosby, B.S.,
Michael C. Mosier, Ph.D., Atef AlSharif, M.D., and David H. Berger, M.D.

Type of Infection	Chlorhexidine-	Povidone-Iodine (N = 440)	Relative Risk (95% CI)*	P Value†
	Alcohol (N = 409)			
	<i>no. (%)</i>			
Any surgical-site infection	39 (9.5)	71 (16.1)	0.59 (0.41–0.85)	0.004
Superficial incisional infection	17 (4.2)	38 (8.6)	0.48 (0.28–0.84)	0.008
Deep incisional infection	4 (1.0)	13 (3.0)	0.33 (0.11–1.01)	0.05
Organ-space infection	18 (4.4)	20 (4.5)	0.97 (0.52–1.80)	>0.99
Sepsis from surgical-site infection	11 (2.7)	19 (4.3)	0.62 (0.30–1.29)	0.26

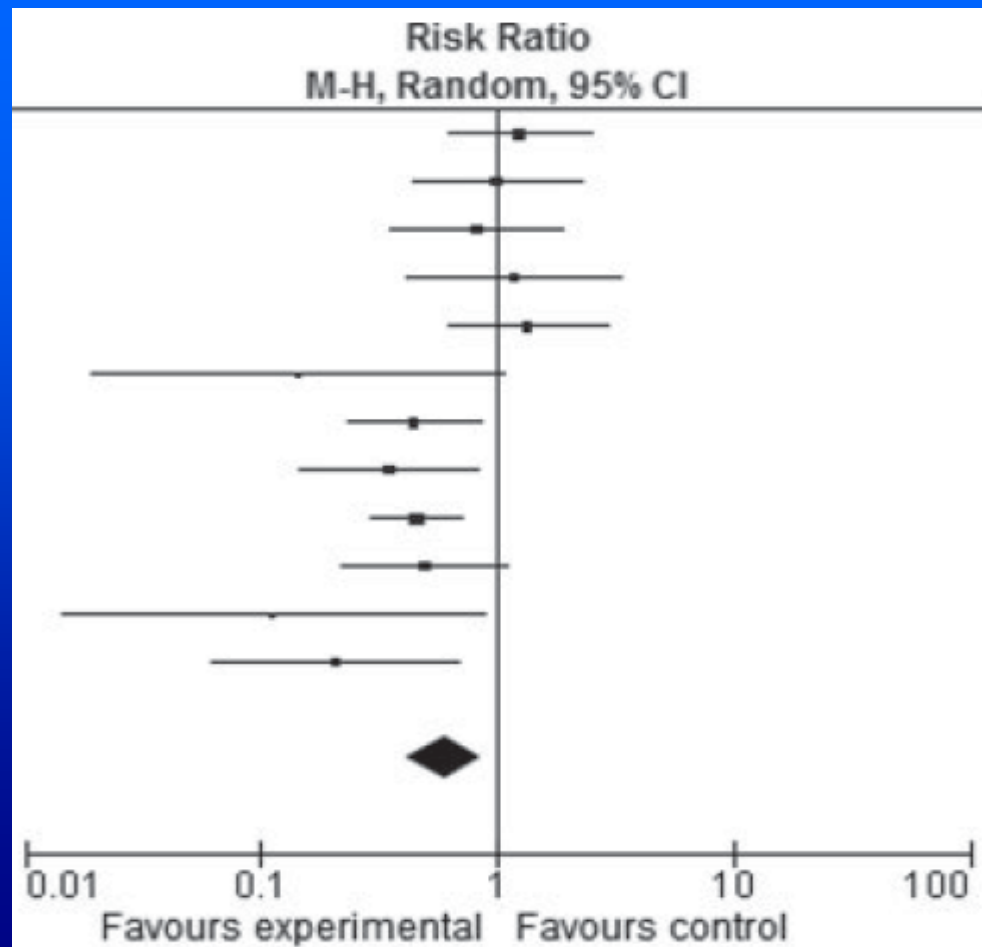
Iodine v. Chlorhexidine & Alcohol v. No Alcohol Only Clean-Contaminated Cases

SSI (%)	Pov Iod No Alcohol	Pov Iod + Alcohol	CHG + Alcohol	Iod Povacryl + Alcohol
Swenson (n=1459)		8.7	10.7	5.9
Darouiche (n=849)	16.1		9.5	

Do Wound Protectors Reduce SSI Risk?



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Do Wound Protectors Reduce SSI Risk?

Wound guards may significantly reduce the incidence of SSI postoperatively in patients undergoing open abdominal surgery when compared with standard care; however, the quality of the available evidence is generally very poor. This is mainly due to methodological flaws and reporting failures. . . . There is a need for high-quality, multicenter RCTs.

Surgical Technique and Risk of SSI

But how do you measure surgical technique?

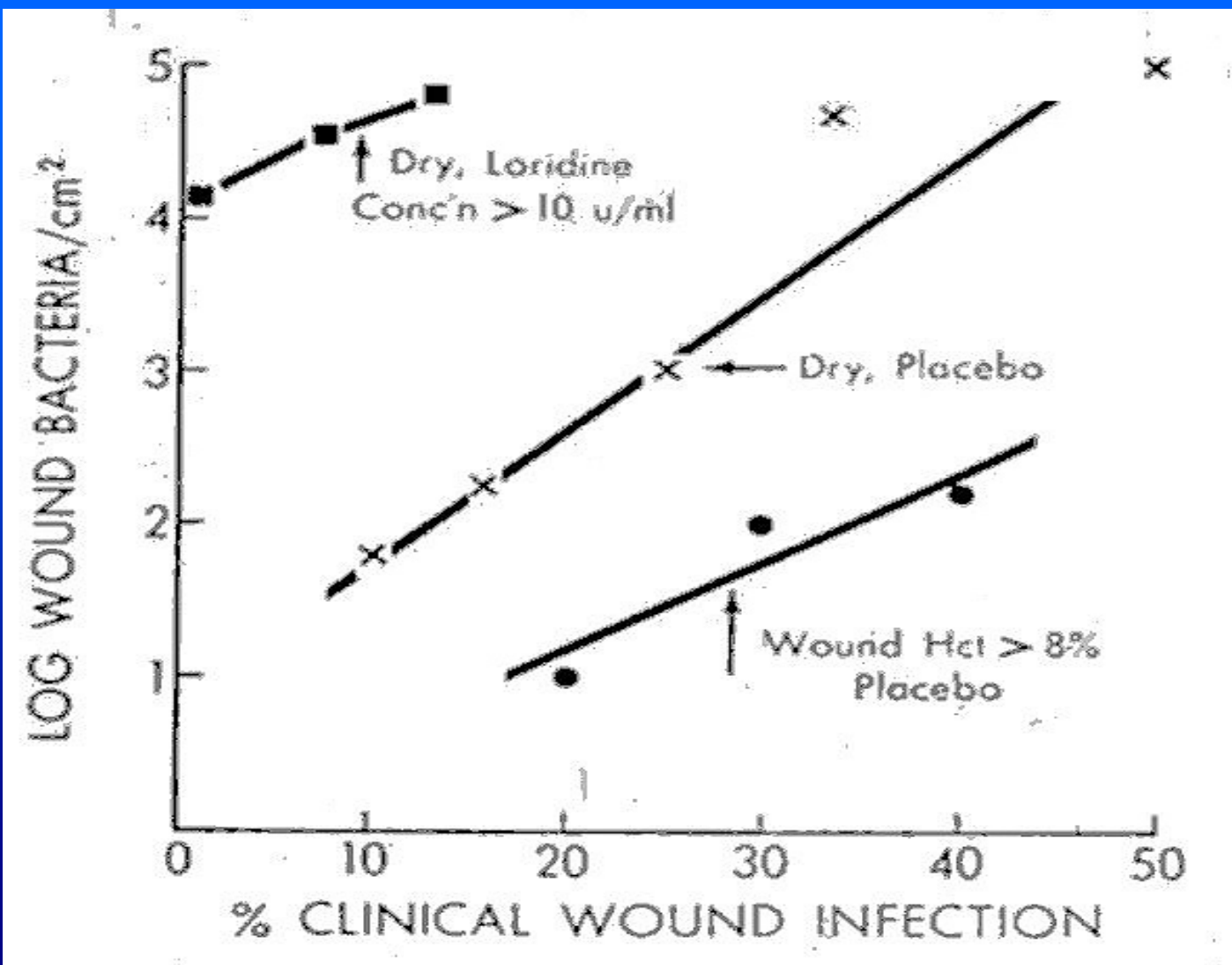
Definition of Ideal Surgical Technique

- The way I would do it
- The way my chief made me do it

Definition of Ideal Surgical Technique

- The way I would do it
- The way my chief made me do it
- **Minimal tissue trauma**
- **Minimal blood loss**
- **Minimal foreign bodies**
- **Short operating time (without sacrificing the above)**

Surgical Technique, Prophylactic Antibiotics and SSI



Septic Complications After Colectomy Relation to Intraoperative Contamination

<u>Contamination</u>	<u>Doxycycline</u>	<u>Placebo</u>
No	7.5%	32%
Yes	39%	84%

Stitch Length and Wound Complications

Stitch Length / Incision length ≥ 4

<u>Complication</u>	<u>Long (≥ 1 cm)</u> <u>n=381</u>	<u>Short (5-8 mm)</u> <u>n=356</u>	<u>p</u>
Dehiscence	1 (0.3%)	0	>0.99
SSI	35/343 (10.2%)	17/326 (5.2%)	0.02
Incis Hernia	49/272 (18%)	14/250 (5.6%)	<0.001

Predictors of SSI

	Odds Ratio (95% CI)
Wound Contamination	2.81 (1.09 – 7.25)
Diabetes	2.73 (1.30 – 5.72)
Long Stitch Length	2.15 (1.17 – 3.96)

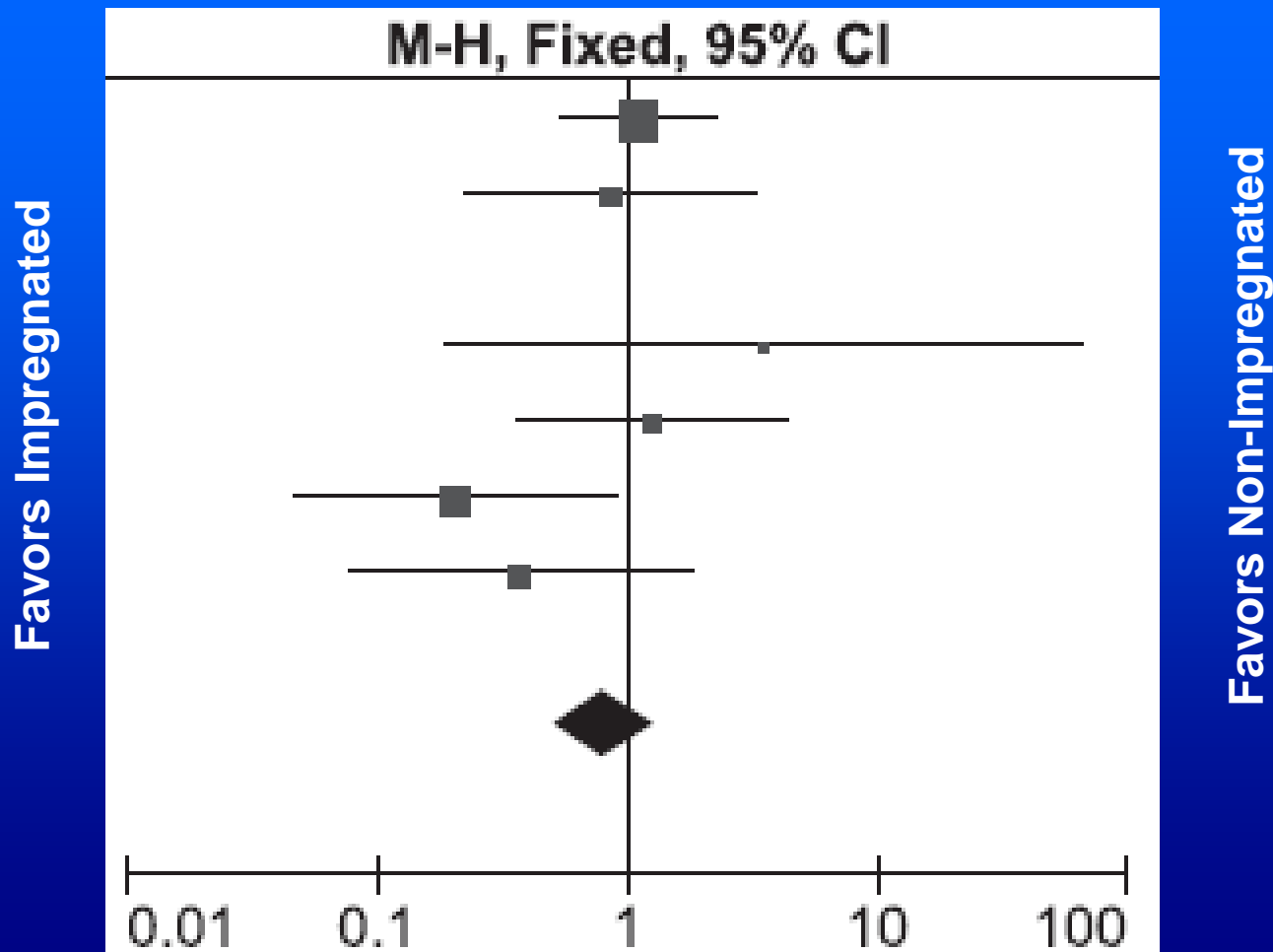
Millbourn. Arch Surg 2009; 144: 1056-9

Should We Use Antimicrobial Impregnated Sutures ?

Number of *S. aureus* required to establish an experimental infection:

- Bacteria alone – 10^6
- Bacteria on silk suture -- 10^2

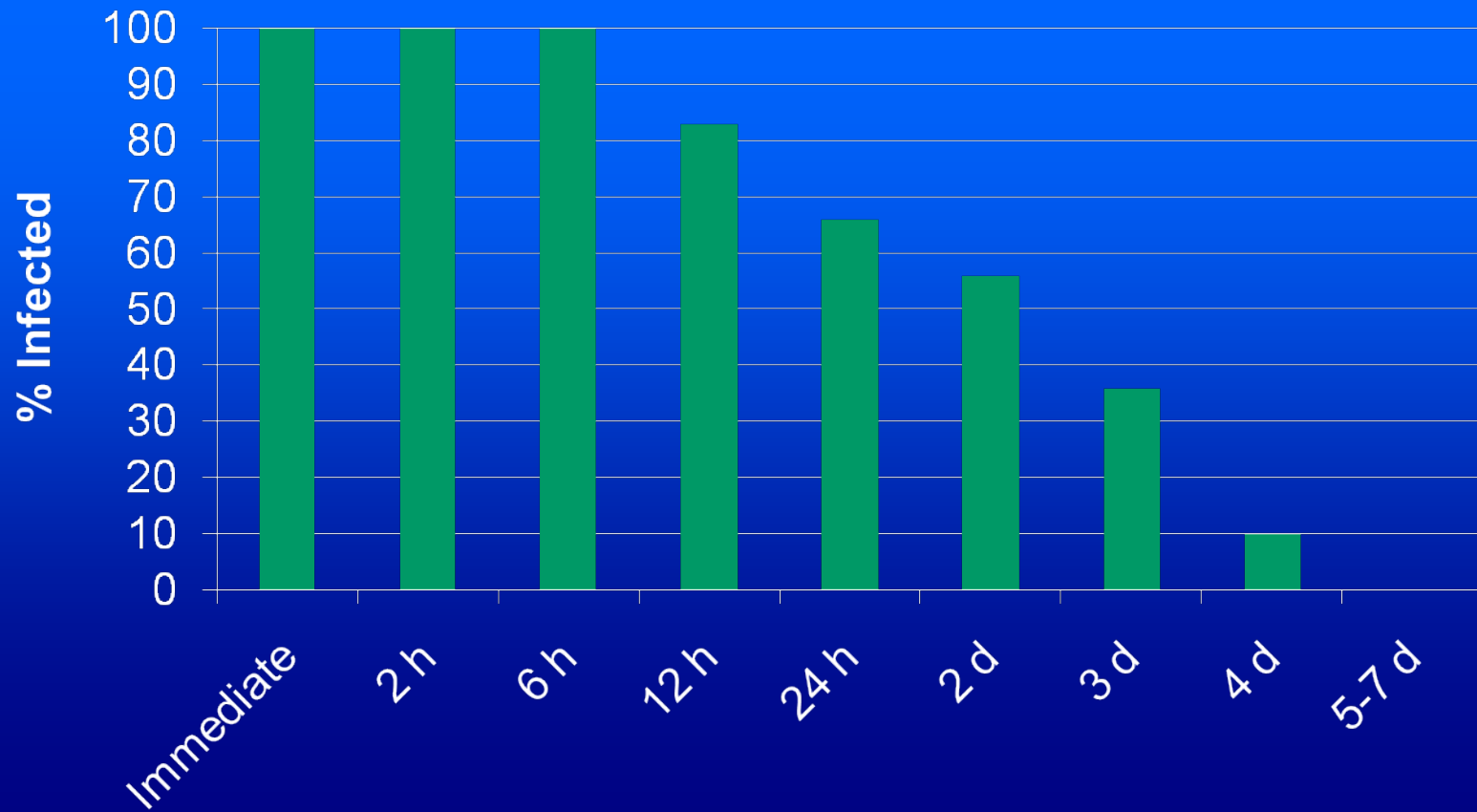
Meta-Analysis of Triclosan-Impregnated Sutures



Dressings and SSI

Time from Incision Closure to Contamination with *S. aureus* and Subsequent SSI

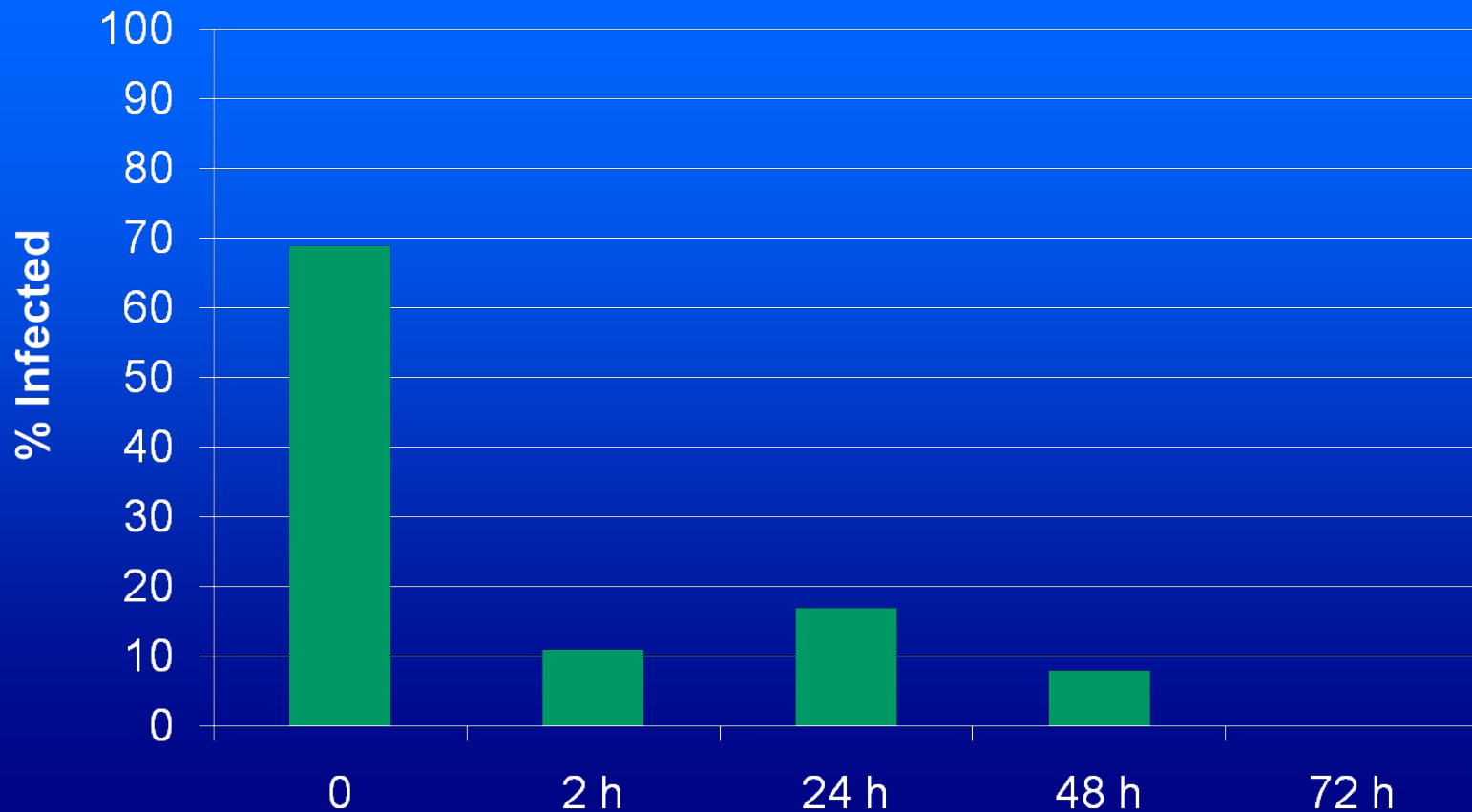
Guinea Pig Laparotomy, Perincisional Skin Swabbed (n=342)



DuMortier. SG&O 1963; 56:762

Time from Suture Closure to Contamination with *S. aureus* and Subsequent SSI

Guinea Pig Paraspinous Incisions (n=78)



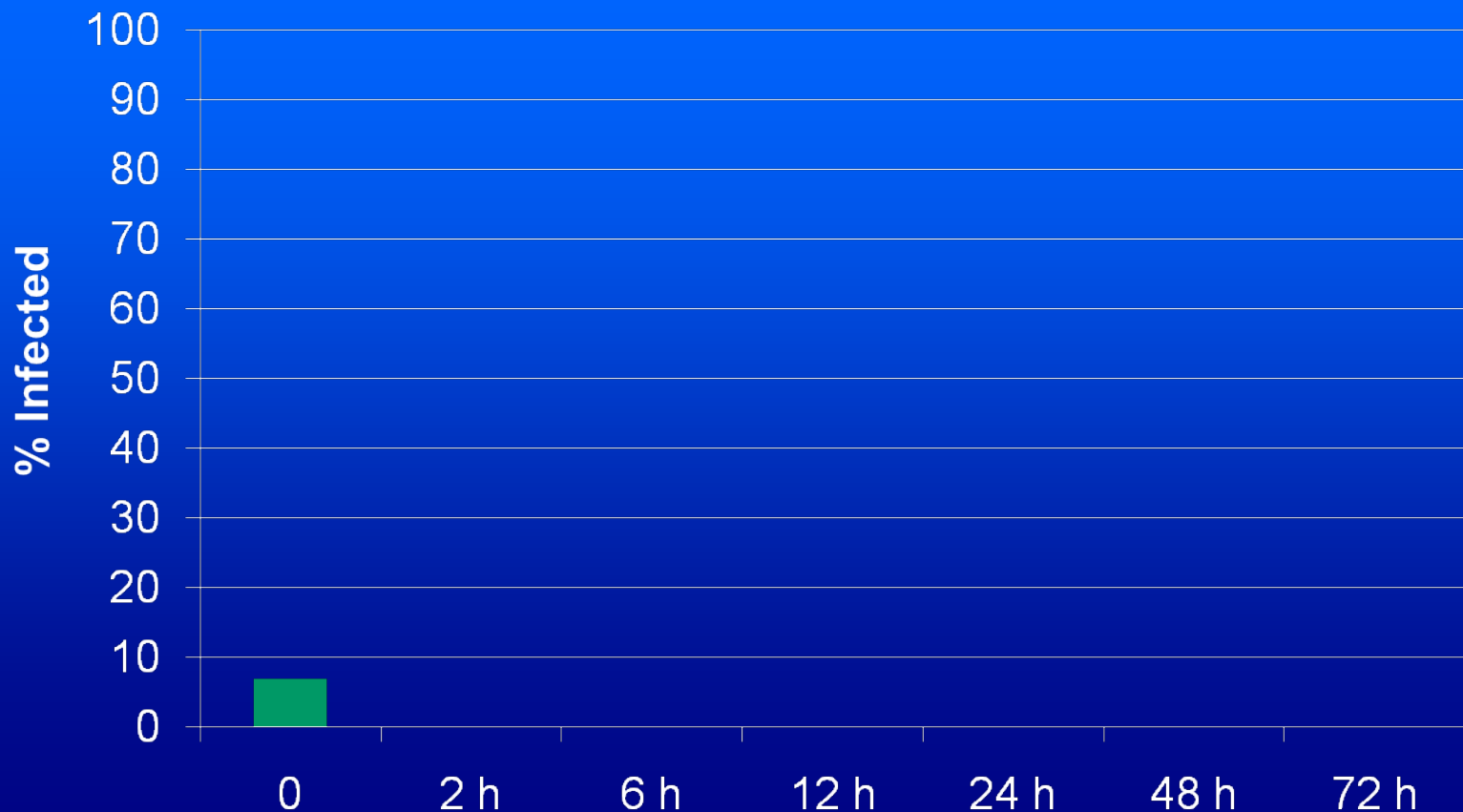
Time from Tape Closure to Contamination with *S. aureus* and Subsequent SSI

Guinea Pig Paraspinous Incisions (n=78)



Time from Tape Closure to Contamination with *E. coli* and Subsequent SSI

Guinea Pig Paraspinous Incisions (n=92)



Postoperative Dressings

So should we leave our O.R. dressings on for 3-5 days after the operation?

The animal data are intriguing, but I don't know of any human data.

I leave my dressings on for a minimum of 3 days and change sterilely if necessary before then.

**Nutrition Evaluation
and Management and
Risk of SSI**

Relation of Preoperative Hypoalbuminemia & SSI Risk in Gastrointestinal Operations

Multivariate Analysis of Risk for SSI

	<u>P</u>	<u>RR</u>	<u>95% CI</u>
Age (years)	<0.001	1.037	1.021 - 1.052
Albumin < 3.0 mg/dL	<0.001	5.68	3.45 - 9.35

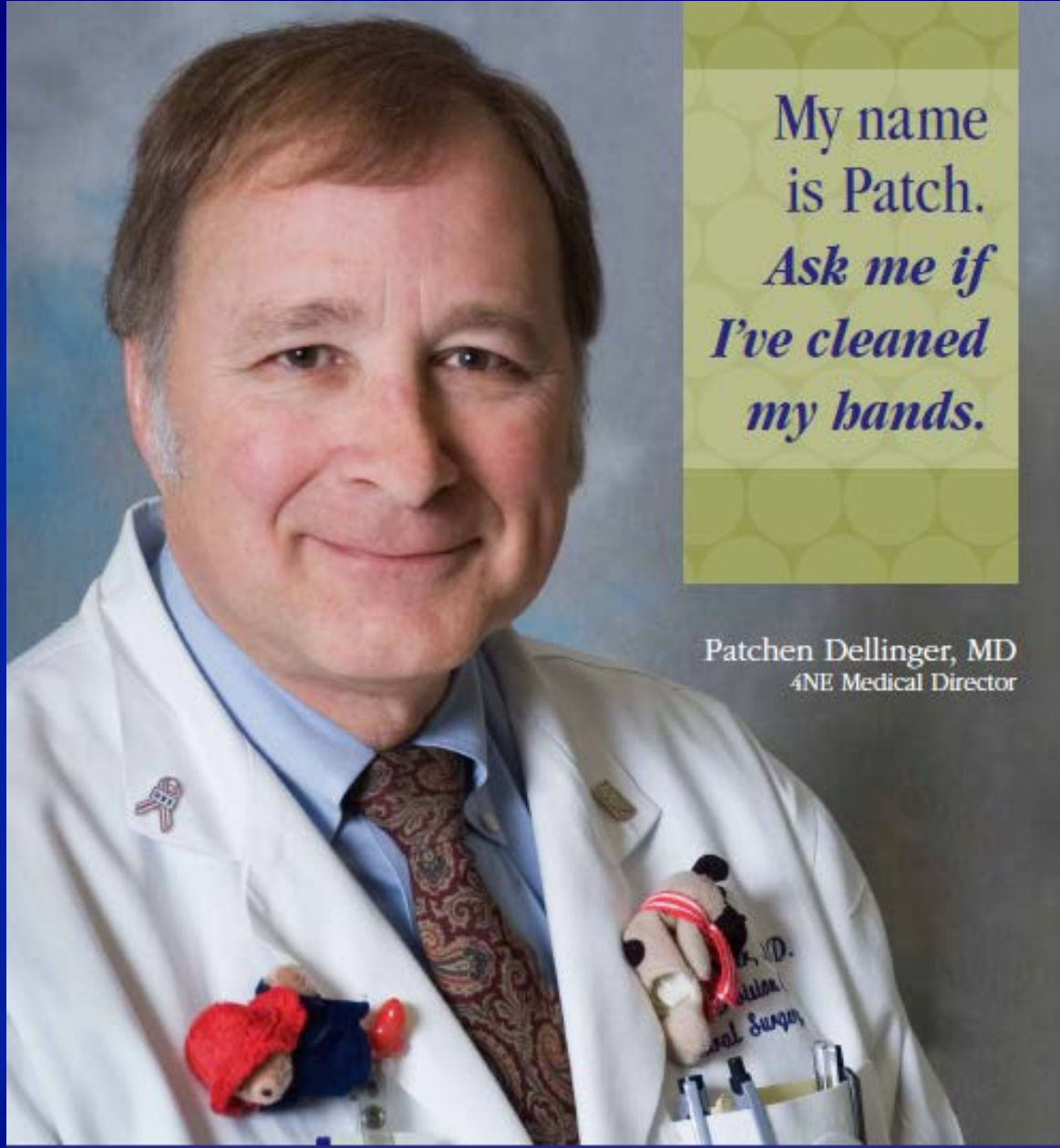
Preoperative Prealbumin Levels and Infectious Complications in Gastric Surgery

	<u>P</u>	<u>OR</u>	<u>95% CI</u>
Combined resection	0.001	5.72	2.03-16.1
Prealbumin < 18 mg/dL	0.032	3.00	1.10-8.19

Perioperative Immunonutrition and Infection Risk

Arginine + ω -3 fatty acids

	<u>RR</u>	<u>95% CI</u>	<u>p</u>
Preop	0.48	0.31-0.74	0.001
Periop	0.53	0.38-0.76	0.0004
Postop	0.68	0.58-0.80	0.00001



My name
is Patch.
*Ask me if
I've cleaned
my hands.*

Patchen Dellinger, MD
4NE Medical Director

Preventing infections is in our hands.

UNIVERSITY OF WASHINGTON
MEDICAL CENTER
UW Medicine