Infection Control in Immunocompromised Patients

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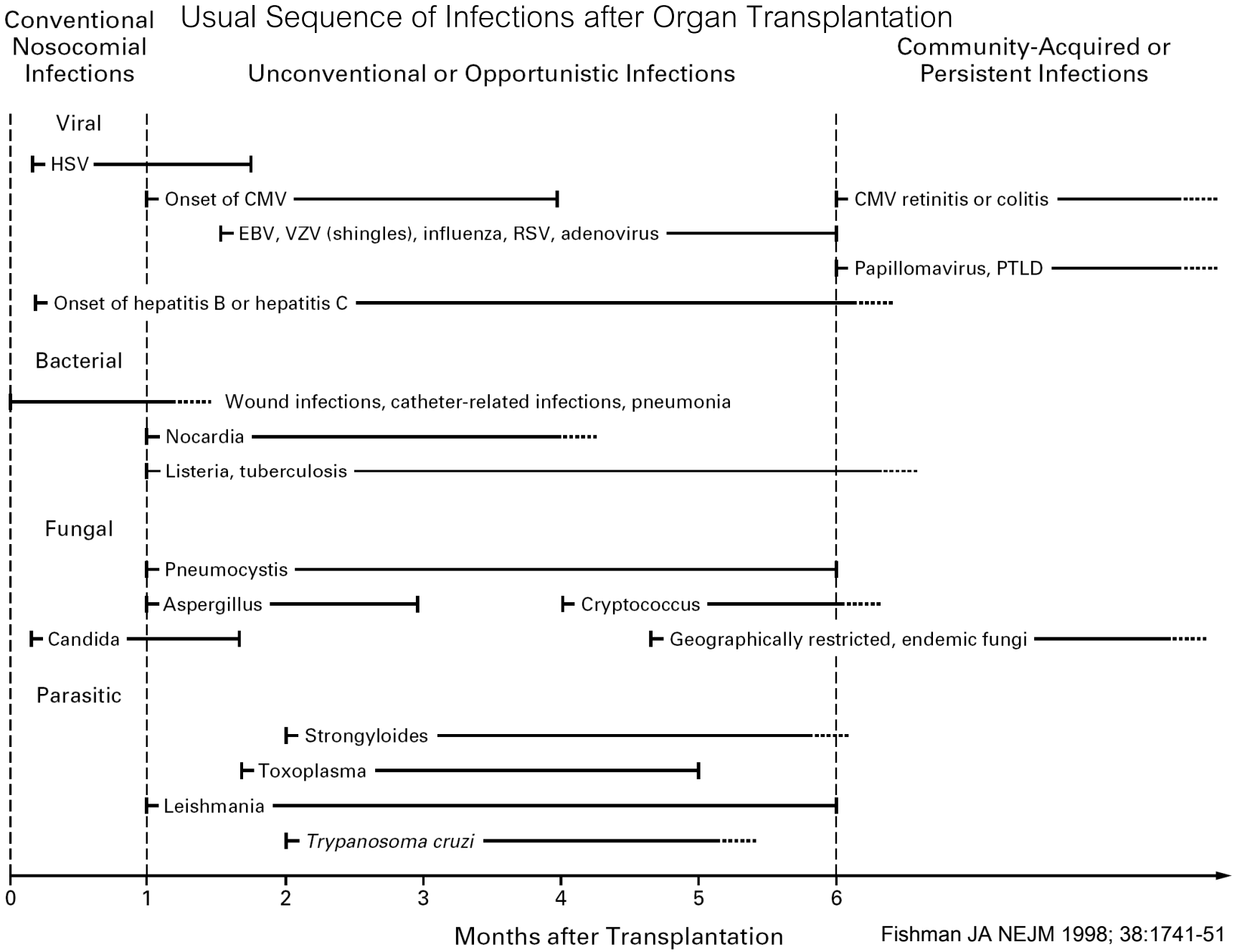
Outline

- Type of immunocompromised state
- Infection complications in kidney transplant recipient
- Infection in other types of host

Immunocompromised state

- Impaired phagocyte function and number
  - Neutropenia
  - Steroid users
- Impaired cellular immune response
  - Kidney and other organ transplant recipients
  - Steroid users
  - AIDS
- Anatomical barrier: solid organ transplant



Fishman JA NEJM 1998; 38:1741-51

Infectious complications after kidney transplantation

Alangaden GJ, et al. Clin Transplant 2006: 20: 401–409

Protocol and findings

- Observational study in 127 adult recipients transplanted from 2001 to 2004
- Induction: thymoglobulin (50%) or basiliximab (50%), maintained on mycophenolate mofetil, either tacrolimus (73%) or sirolimus (27%), and prednisone (79%)
- Antimicrobial prophylaxis: perioperative cefazolin

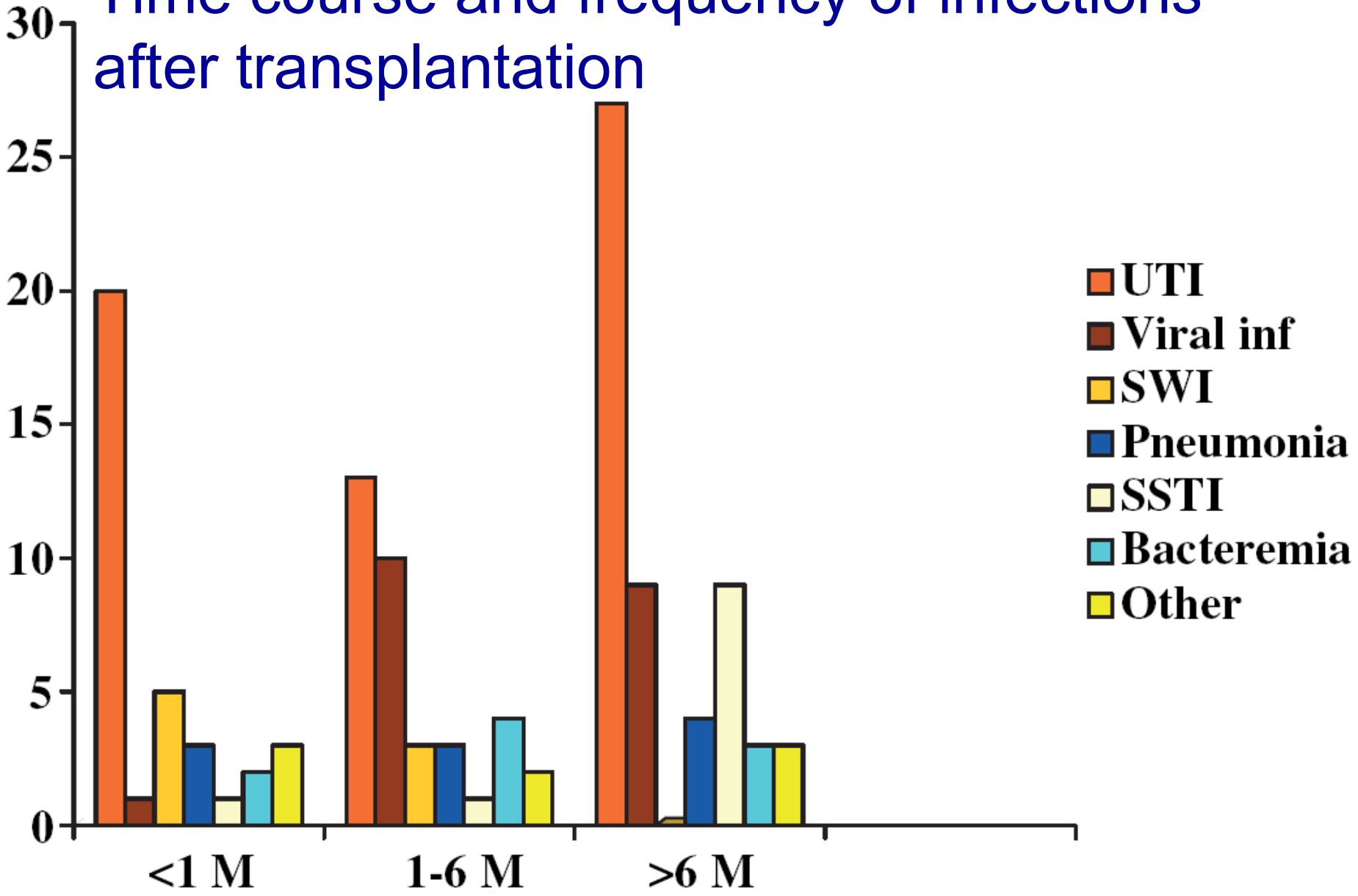
Alangaden GJ, et al. Clin Transplant 2006: 20: 401–409

Protocol and findings

- 127 infections in 65 patients
  - 60 episodes of UTI 47% among 31 pts.
    - 16 recurrent UTI
    - 8 bacteremia
    - 6 caused by gram-negative bacilli
  - Viral infections 17%
  - Pneumonia 8%
  - Surgical wound infections (7%)

Alangaden GJ, et al. Clin Transplant 2006: 20: 401–409

Time course and frequency of infections after transplantation



- Alangaden GJ, et al. Clin Transplant 2006: 20: 401–409

Risk factors for infections

Category	Risk factor	OR	p-value	95% CI
Bacterial	LD	4.4	0.004	1.6–11.9
	DM	2.65	0.03	1.1–6.6
	ATG	3.3	0.009	1.3–7.9
	SRL	2.5	0.047	1.1–6.4
Viral	DGF	3	0.034	1.1–8.3
Fungal	DM	13.5	0.035	1.2–151.0
UTI	Retransplant	4.5	0.059	0.95–21.2
	Stent	2.9	0.029	1.1–7.4
Recurrent UTI	DM	12.6	0.025	1.4–114.7
	ESRD yr	0.7	0.033	0.54–0.97
	Retransplant	140.4	0.001	6.9–2873.2

- Alangaden GJ, et al. Clin Transplant 2006: 20: 401–409

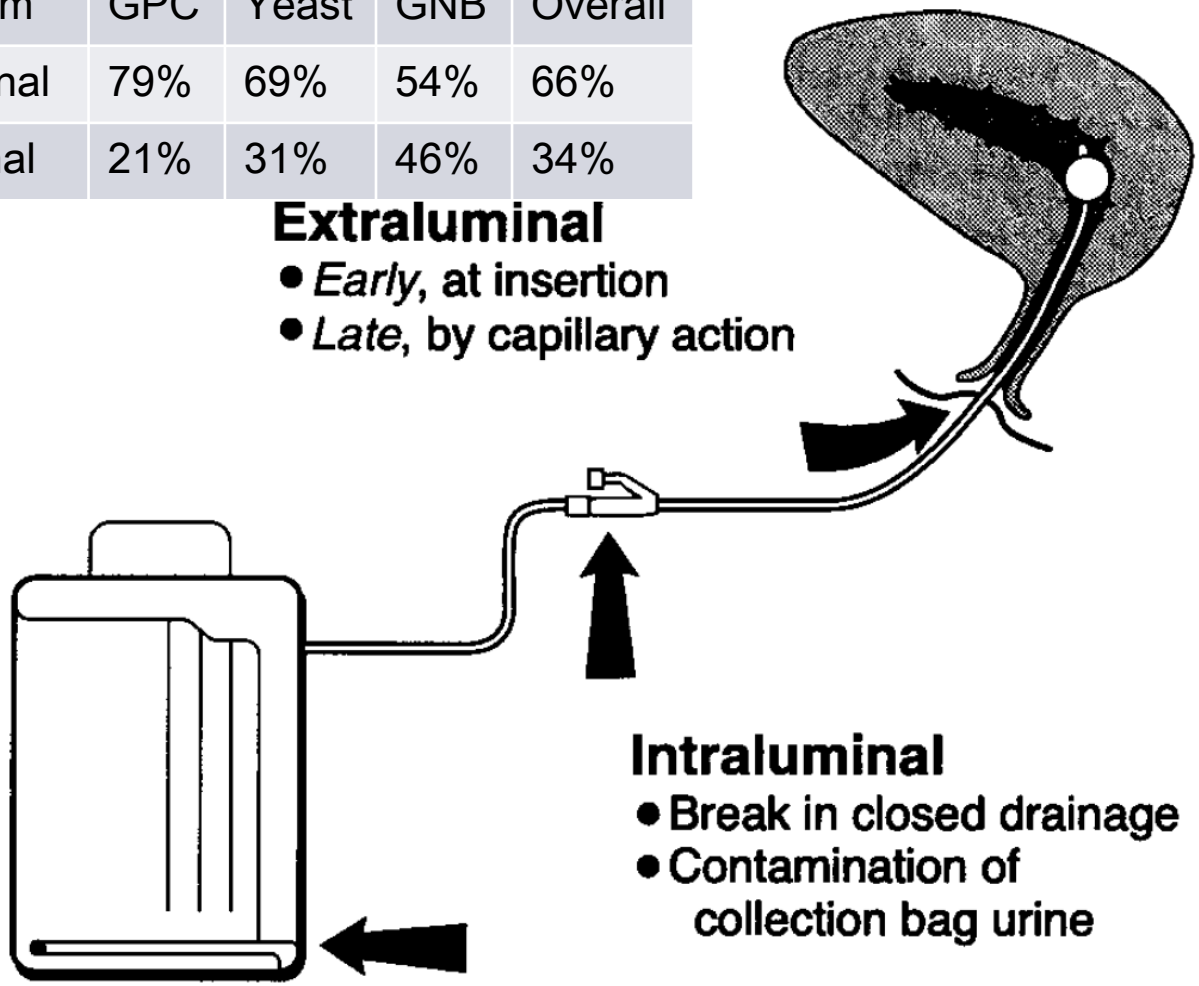
Urinary tract infections (UTIs) occurring in patients receiving kidney transplants have continued to be a perplexing problem.[1-6] Urinary tract infections are the most common infection in this group of immunosuppressed patients,[7] are reportedly associated with severe morbidity in terms of sepsis,[5,8] and have been implicated as a possible cause in transplant rejection.[9]

Don E. Ramsey, MD; W. Tyree Finch, MD; Alan G. Birtch, MD

Arch Surg **114:1022-1025, 1979**

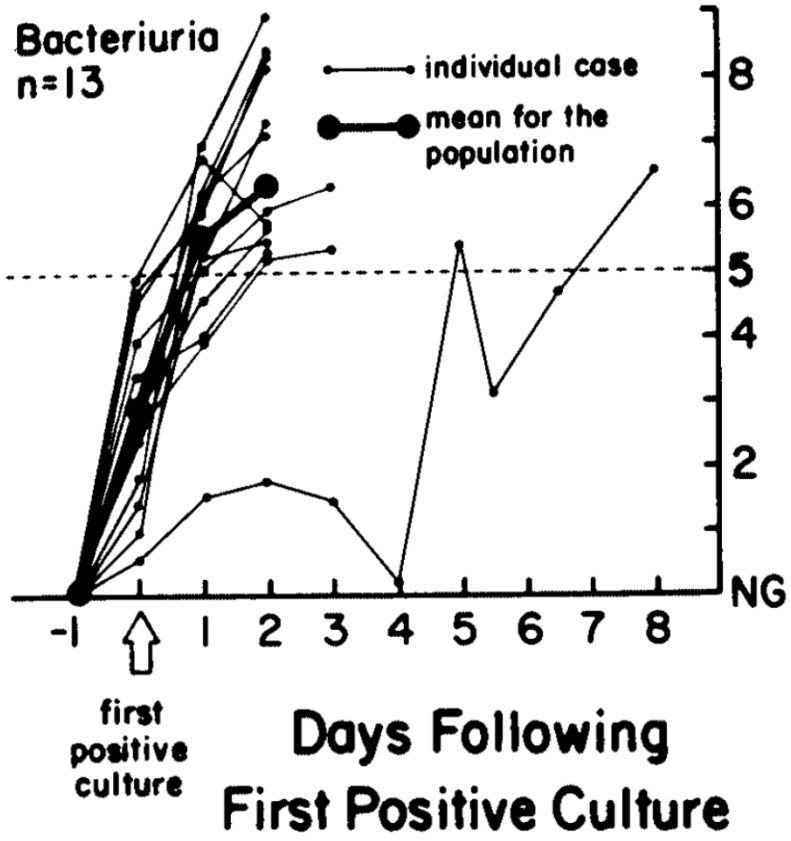
Pathogenesis of CAUTI in general patients

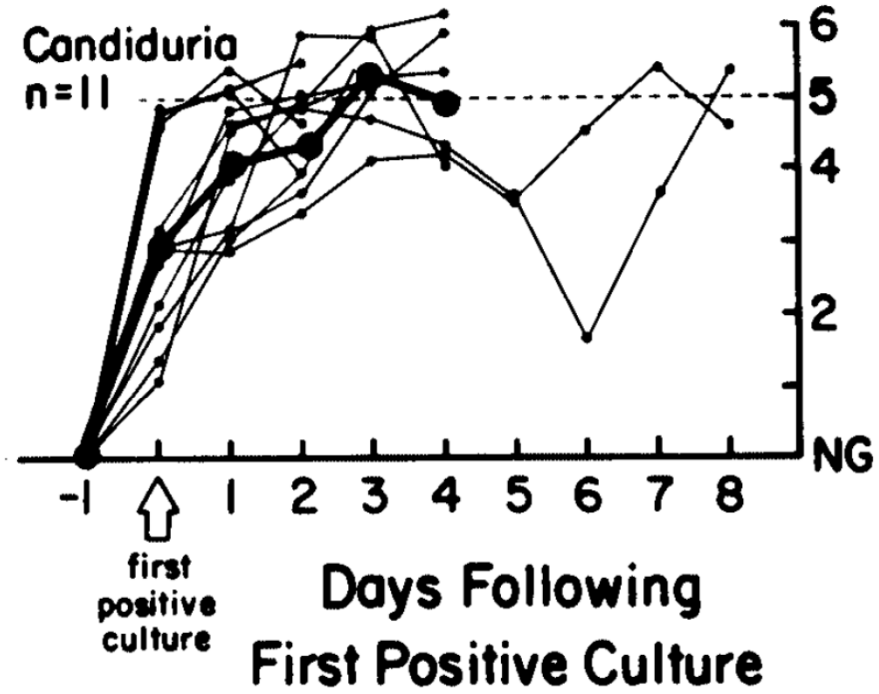
	Organisms causing CAUTI			
Mechanism	GPC	Yeast	GNB	Overall
Extraluminal	79%	69%	54%	66%
Intraluminal	21%	31%	46%	34%



Maki DG and Tambyah PA. EID 2001; 7:342-7

Pathogenesis of CAUTI in general patients





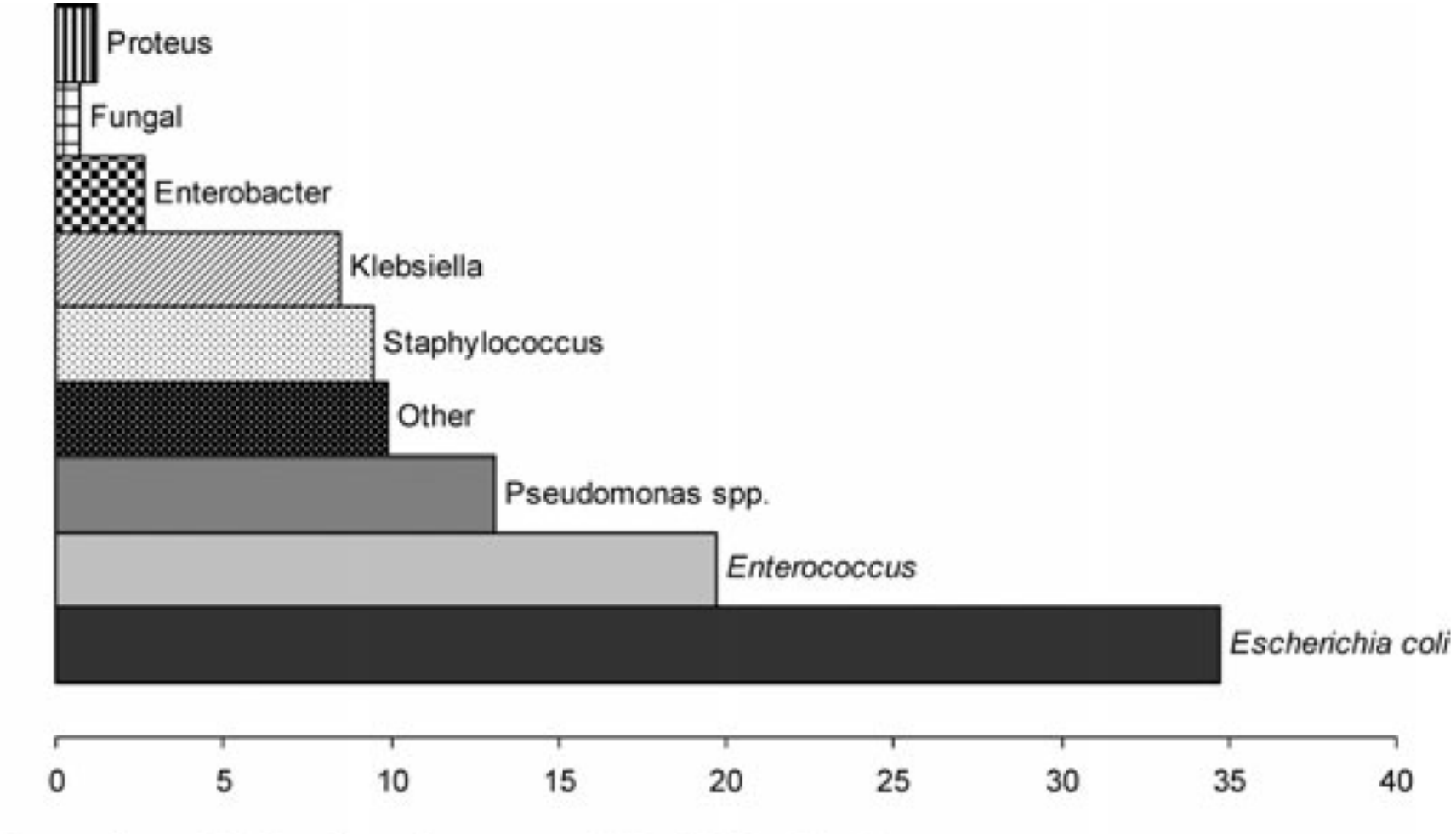
Stark RP, Maki DG. N Engl J Med 1984;311:560-4.

Risk factors for CA-UTI in general patients

Factor	Relative risk
Prolonged catheterization >6 days	5.1-6.8
Female gender	2.5-3.7
Catheter insertion outside operating room	2.0-5.3
Urology service	2.0-4.0
Other active sites of infection	2.3-2.4
Diabetes	2.2-2.3
Malnutrition	2.4
Azotemia (creatinine >2.0 mg/dL)	2.1-2.6
Ureteral stent	2.5
Monitoring of urine output	2
Drainage tube below level of bladder and above collection bag	1.9
Antimicrobial-drug therapy	0.1-0.4

Maki DG., Tambyah PA. Emerg Infect Dis 2001; 7:1-6

UTI in kidney transplanted-recipients



Rice J. C. American Journal of Transplantation 2009; 9 (Suppl 4): S267–S272

Major risk factors for bacterial UTI in renal transplant recipients

Risk factor	OR (95% CI)
Female gender	5.8 (3.79–8.89)
Age (per year)	0.02 (1.01–1.04)
Reflux kidney disease prior to transplantation	3.0 (1.05–8.31)
Deceased donor	3.64 (1.0–12.7)
Duration of bladder catheterization	1.50 (1.1–1.9)
Length of hospitalization prior to UTI	0.92 (0.88–0.96)
Increase in immunosuppression	17.04 (4.0–71.5)

Rice J. C. American Journal of Transplantation 2009; 9 (Suppl 4): S267–S272

TABLE 3. Risk factors for early UTI (Growth of 10^5 or more colony-forming units/mL urine)

		Multivariable analysis	
Variable	**n (%)**	**HR (95% CI)**	***P***
Age (per decade increase)	1166 (100.0)	**1.11 (1.01–1.23)**	**0.03**
Female	452 (38.8)	**2.87 (2.21–3.73)**	**<0.001**
African American	320 (27.4)	1.01 (0.75–1.35)	0.96
Diabetes mellitus	364 (31.2)		
Prior kidney transplant	125 (10.7)		
Deceased-donor transplant	607 (52.1)	0.97 (0.72–1.32)	0.86
Ureteral stent	532 (45.6)	**1.40 (1.07–1.82)**	**0.01**
Vancomycin prophylaxis[a]	136 (11.7)	1.19 (0.84–1.69)	0.33
Antithymocyte globulin induction	1008 (86.4)		
Corticosteroid maintenance[b]	217 (18.6)		
DGF[c]	249 (21.4)	**1.38 (0.99–1.92)**	**0.06**
Prolonged use of Foley catheter[d]	89 (7.6)	**3.92 (2.83–5.43)**	**<0.001**
TMP/SMX prophylaxis[e]	1112 (95.4)	**0.55 (0.34–0.89)**	**0.02**

[d] Continued use of Foley catheter or intermittent self-catheterization beyond 7 days after kidney transplantation

Effect of ureteric stent

- 201 patients were studied, stent (112) and a no-stent (89)
- At 3 months there were significantly more cases of urinary leakage (8.9% vs 0.9%, p <0.008) and ureteral obstruction (7.7 % vs 0%, p <0.004) in the no-stent
- A significant increase in UTI when stent was left >30 days after transplantation compared to the rate in the no-stent group (p <0.02)

Tavakoli A, et al. J Urol 2007; 177: 2260–2264.

Major risk factors for candiduria in renal transplant recipients

Risk factor (references)	OR (95% CI)
Female gender	12.5 (6.70–23.0)
ICU care	8.8 (2.3–35.0)
Prior antibiotic use	3.8 (1.7–8.3)
Indwelling urethral catheter*	4.4 (2.1–9.4)
Neurogenic bladder	7.6 (2.1–27)
Malnutrition	2.4 (1.3–4.4)

*days of bladder catheterization for each day (OR, 1.44; 95% CI, 1.05–1.96; P = .023)
Sorto R et al. Transplantation Proceedings, 42, 280–281 (2010)

Rice J. C. American Journal of Transplantation 2009; 9 (Suppl 4): S267–S272

Major risk factors for acute pyelonephritis in renal transplant recipients

Risk factor (references)	OR (95% CI)
Female gender	5.14 (1.86–14.20)
Acute rejection episodes	3.84 (1.37–10.79)
Number of UTIs	1.17 (1.06–1.30)
Mycophenolate mofetil	1.9 (1.2–2.3)

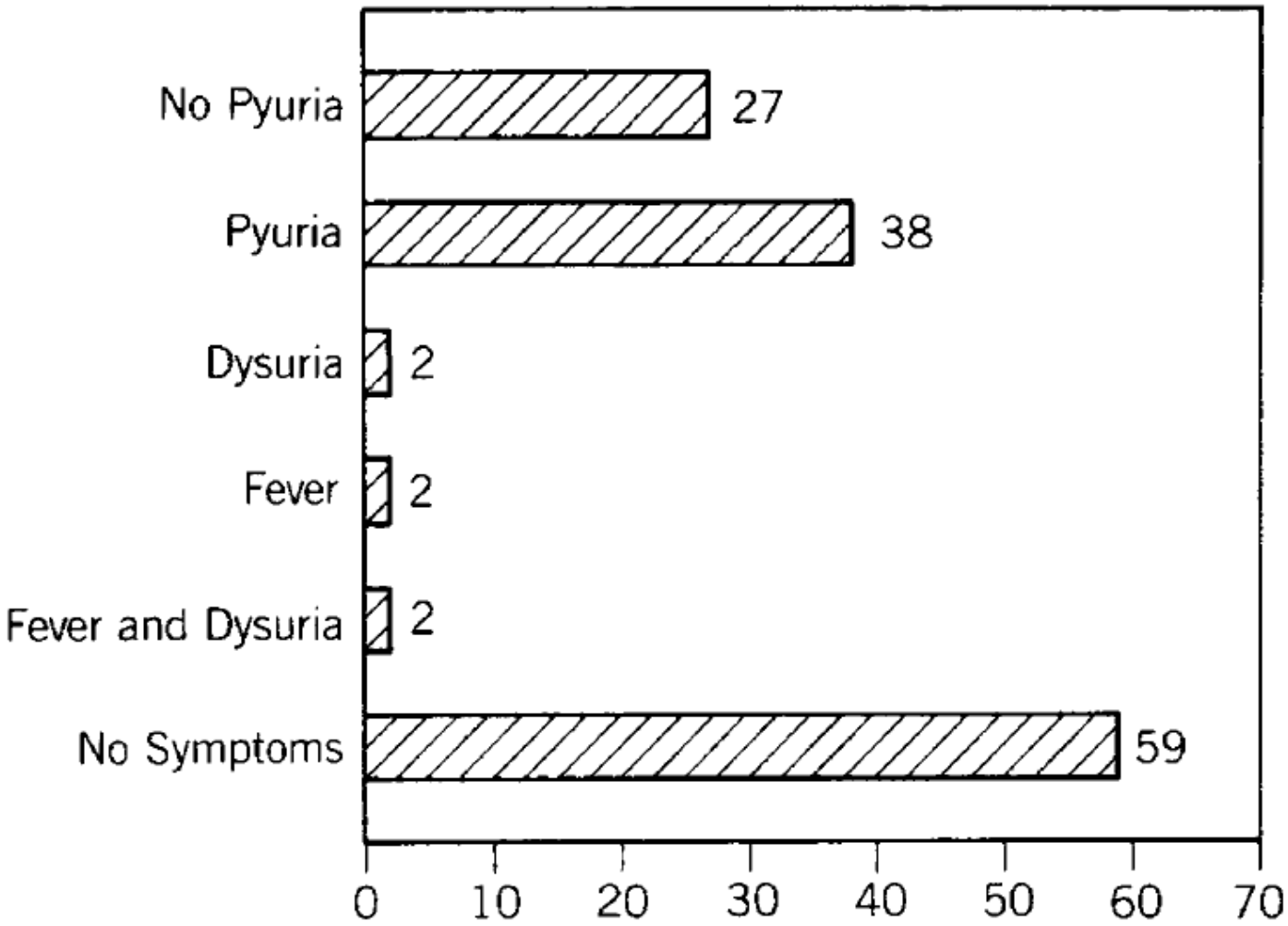
Rice J. C. American Journal of Transplantation 2009; 9 (Suppl 4): S267–S272

Factors affecting the net state of immunosuppression in transplant recipients

- Immunosuppressive therapy: dose, duration, and temporal sequence
- Underlying immune deficiency: autoimmune disease, functional immune deficits
- Integrity of the mucocutaneous barrier: catheters, epithelial surfaces
- Devitalized tissue, fluid collections
- Neutropenia, lymphopenia
- Metabolic conditions: Uremia, malnutrition, DM, alcoholism with cirrhosis
- Infection with immunomodulating viruses: CMV, Epstein–Barr virus, hepatitis B and C viruses, HIV

Fishman JA NEJM 1998; 38:1741-51

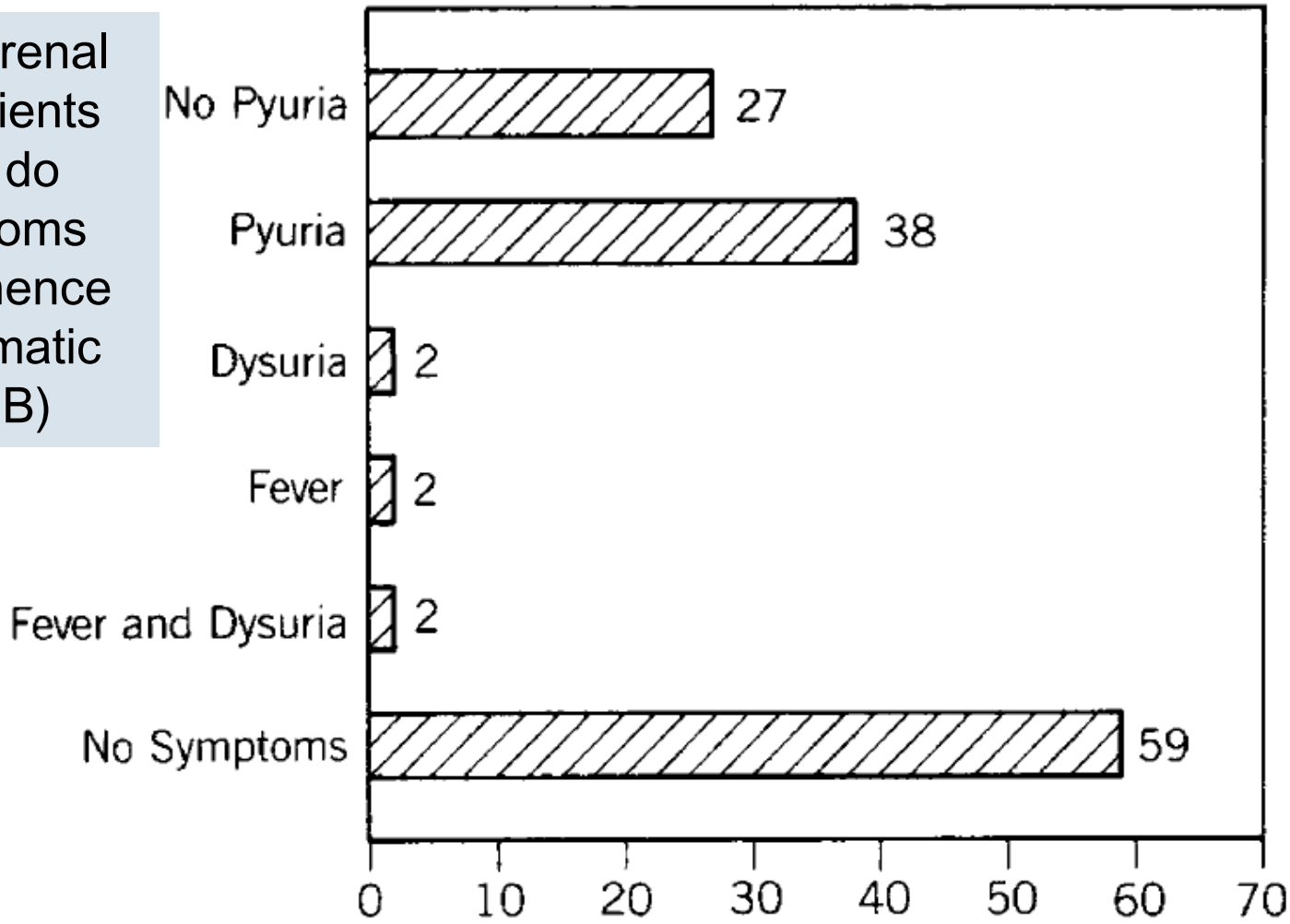
Clinical features of UTI in kidney transplant



Ramsey DE, FinchWT, Birtch AG. Arch Surg 1979; 114: 1022–1025

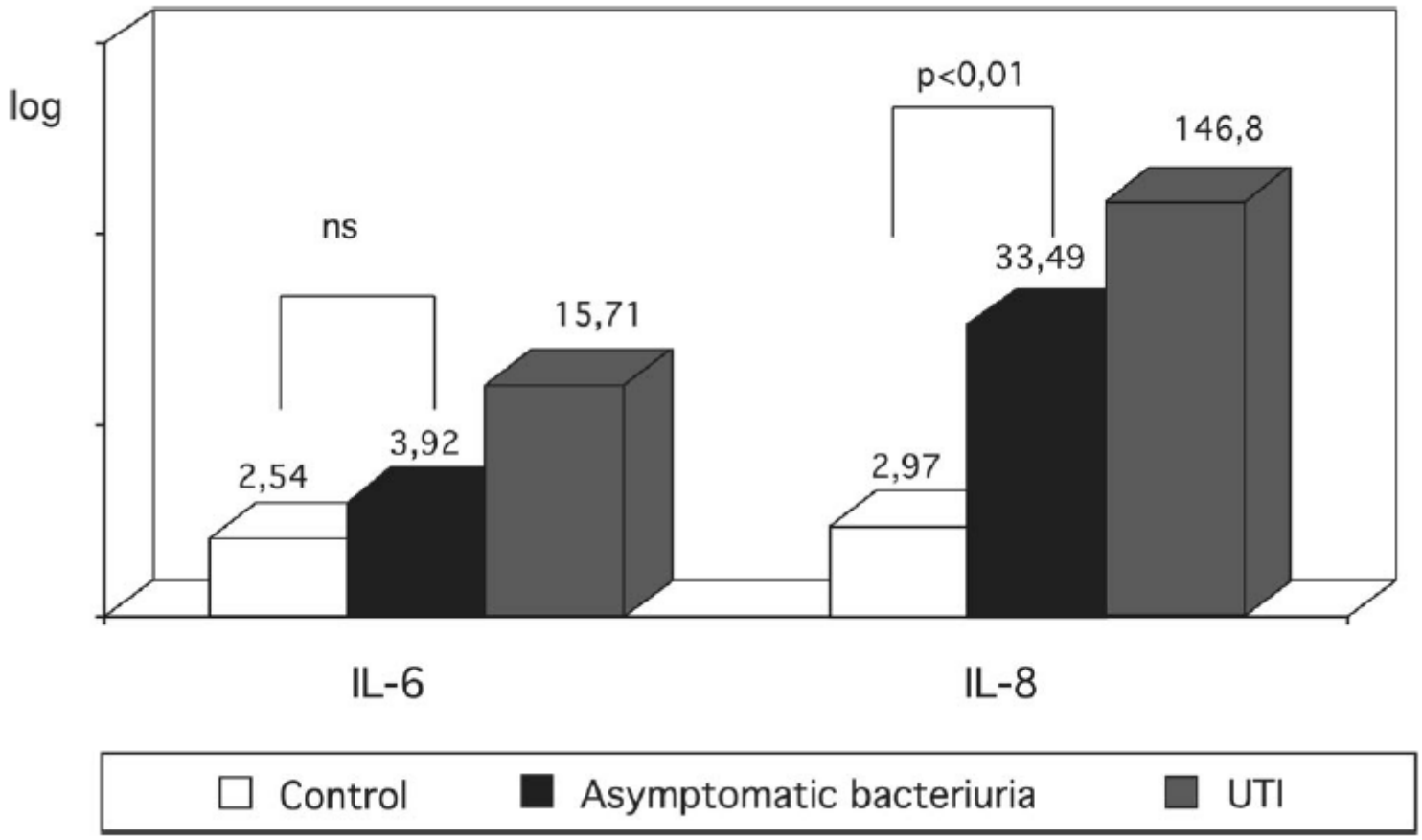
Clinical features of UTI in kidney transplant

The majority of renal transplant recipients with bacteriuria do not have symptoms with their UTI, hence have “asymptomatic bacteriuria” (ASB)



Ramsey DE, FinchWT, Birtch AG. Arch Surg 1979; 114: 1022–1025

Cytokine response in ASB



Median IL-6 and IL-8 urine concentration (pg/mg creatinine), logarithmic scale

Ciszek M et al Transplantation 2006;81: 1653–1657

Implications

- Definition of “UTI”: symptoms included?
- Prolonged urinary catheterization >7 days definitely increased risk of both symptomatic UTI and ASB
- Ureteric stent plays role, but to what extent? – plus weight against risk of leakage

Urinary tract infection

- ปัจจัยเสี่ยงที่สำคัญที่สุด:
  - การคาสายสวนปัสสาวะไว้นานๆ
  - การผ่าตัดระบบทางเดินปัสสาวะ

Summary of recommendations:

- Appropriate Urinary Catheter Use
- Proper Techniques for Urinary Catheter Insertion
- Proper Techniques for Urinary Catheter Maintenance
- Quality Improvement Programs
- Administrative Infrastructure
- Surveillance

Guideline for prevention of catheter- associated urinary tract infections,CDC;2009

Appropriate Urinary Catheter Use:

- Acute urinary retention or bladder outlet obstruction
- Accurate measurements of urinary output
- Perioperative use: only as necessary

Appropriate Urinary Catheter Use:

- Assist in healing of open sacral or perineal wounds in incontinent patients
- Prolonged immobilization
- Improve comfort for end-of-life care

Properly secure indwelling catheters

Proper Techniques for Urinary Catheter Care

- Hand hygiene immediately before and after insertion or any manipulation of the catheter device or site

Proper Techniques for Urinary Catheter Maintenance

- If breaks in aseptic technique, or disconnection, or leakage occur, replace the catheter and collecting system using aseptic technique and sterile equipment

Proper Techniques for Urinary Catheter Maintenance

- Use urinary catheter systems with preconnected, sealed catheter-tubing junctions

Proper Techniques for Urinary Catheter Maintenance

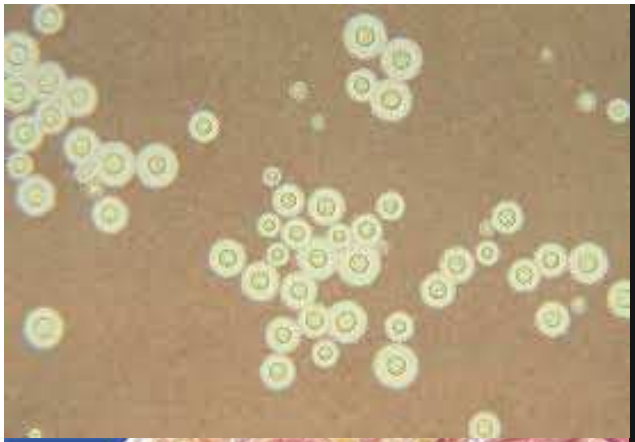
- Maintain unobstructed urine flow; free from kinking, below the bladder all the times, do not rest the bag on the floor.

Proper Techniques for Urinary Catheter Maintenance

- Do not clean the periurethral area with antiseptics to prevent CAUTI while the catheter is in place.
- Routine hygiene (eg, cleansing of the meatal surface during daily bathing or showering) is appropriate.

Surgical site infections

Other infections



Food-borne illness

- *Salmonella enterica*
- *Aeromonas hydrophila*
- *Vibrio vulnificus*
- *Streptococcus suis*

Airborne diseases

- Droplet transmissions
  - Respiratory virus
- Airborne transmissions
  - Herpes zoster (disseminated)/ varicella zoster
  - Tuberculosis

ไข้หวัดใหญ่แพร่ได้อย่างไร

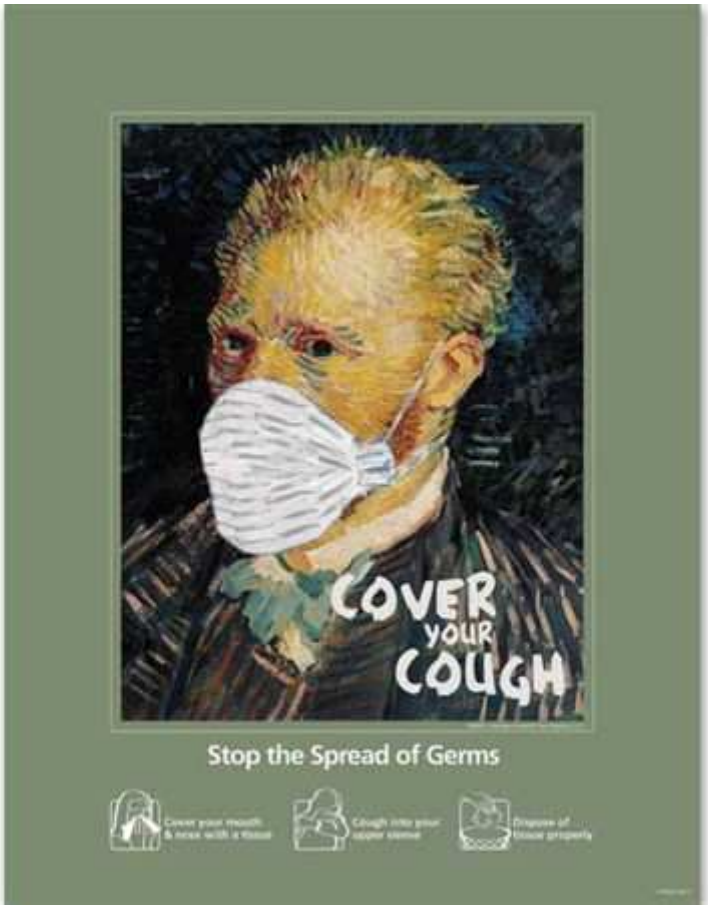
- ไอ จามรดกัน
- การสัมผัสสารคัดหลั่งโดยตรงหรือสัมผัสพื้นผิวที่เปื้อนสารคัดหลั่ง
- การใช้สิ่งของรับประทานอาหารร่วมกัน

การป้องกัน

- ผู้ป่วยที่มีสุขภาพไม่ดี อาจเสียชีวิตจากการติดเชื้อไวรัสระบบทางเดินหายใจได้
- การป้องกัน
  - วัคซีน
  - Respiratory Hygiene/Cough Etiquette

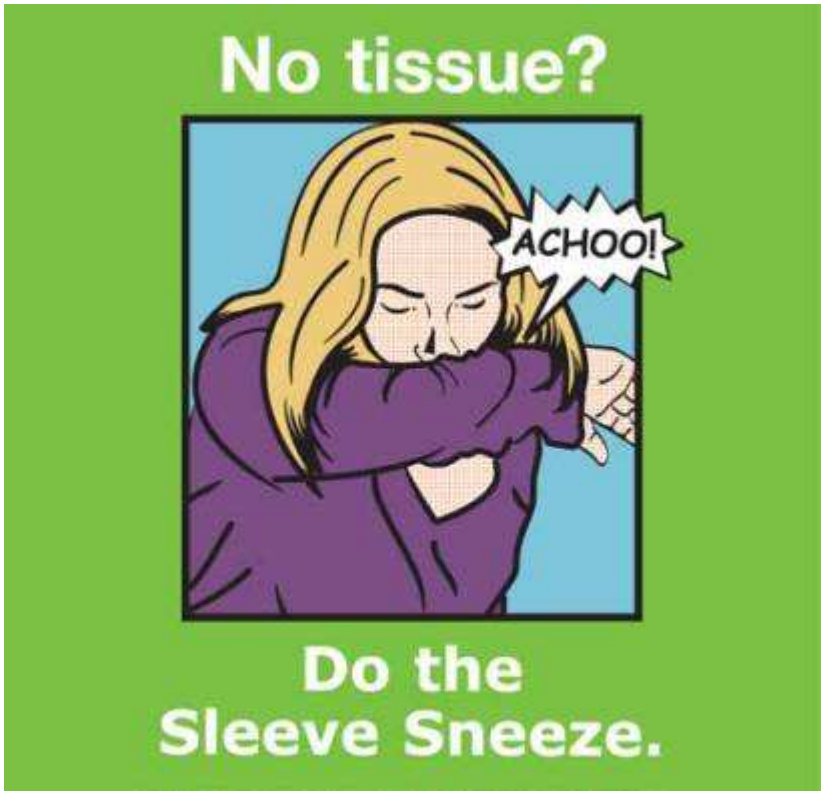
Respiratory Hygiene/Cough Etiquette

- Source control measures



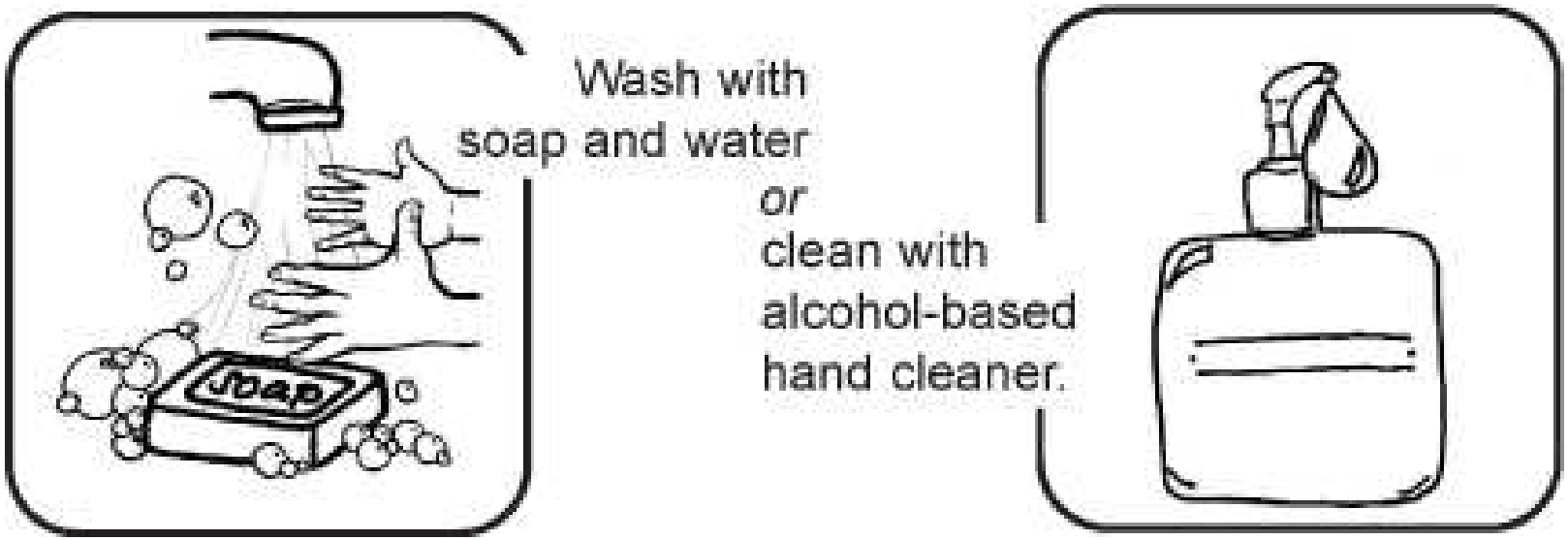
Respiratory Hygiene/Cough Etiquette

- Source control measures



Respiratory Hygiene/Cough Etiquette

- Hand hygiene after contact with respiratory secretions

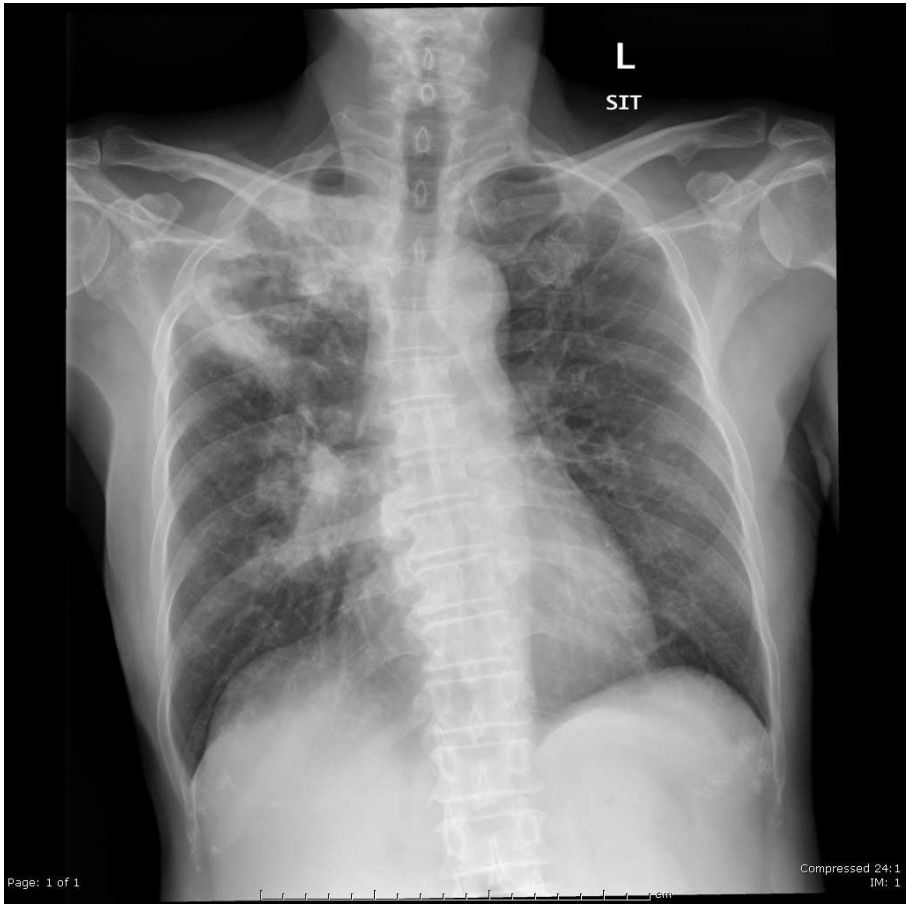


- Spatial separation, ideally >3 feet, of persons with respiratory infections

ข้อปฏิบัติสำหรับบุคลากร

- หลีกเลี่ยงการอยู่ใกล้ชิดกับผู้ป่วยเมื่อท่านเป็นหวัด
- สวม surgical mask เมื่อป่วย
- ฉีดวัคซีนทุกปี

Airborne disease



Herpes zoster

- 1 dermatome: standard precautions
- Disseminated: airborne precautions

Herpes zoster

- Exposed HCW or patients: HZV immunoglobulin and HZV vaccine
- All HCWs without protective antibody against HZV should receive 2 doses of varicella zoster vaccine
- Exposed HCW should be monitored starting D8 after exposure for possible HZV disease

Tuberculosis

Key Points for TB Prevention in Hospitals

- Early diagnosis
  - Check CXR, esp. those who will enter closed area – OR, wards with air-conditioning systems
- Early treatment
- Early isolation or discharge
  - Negative pressure ventilation or open air
  - Surgical mask for patients, N-95 mask for HCWs