A case of polymicrobial bacteremia

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Conflict of interests

- None to declare

Mr. W.

- 66 year-old male, presents with fever
- Past medical history:
  - Ischemic CMP, EF 20-25% post-CABG X 3, PM-ICD
  - Mitral valve repair
  - Paroxysmal atrial fibrillation, CHADS score of 2, on Warfarin
  - Right trochanteric bursitis, complicated by gluteal abscesses, 6 months prior to admission, treated with 9 weeks of ceftriaxone and metronidazole, switched to amoxicillin-clavulanate
  - Peripheral vascular disease, S/P aorto-bifemoral bypass 6 years prior to admission

Mr. W.

- Admitted to the Internal Medicine Ward for:
  - Fever, hypotension, hypoxic respiratory failure
  - *Klebsiella* bacteremia likely from aspiration pneumonia
  - Good response to 7 days of ceftriaxone and doxycycline
  - Kept in-hospital for social issues

- Investigated for microcytic anemia:
  - Gastroscopy: Barrett's esophagus, otherwise normal up to D3
  - Colonoscopy: considered too risky given recent NSTEMI and normal CT-enterography in 2013

Mr. W.

- On the day of his scheduled discharge:
  - New-onset fever : 38.6ºC
  - Blood cultures repeatedly positive for *Pseudomonas aeruginosa*, *Citrobacter braaki*, Vancomycin-resistant *Enterococcus*
  - Broad-spectrum antibiotics started: linezolide, ciprofloxacin, metronidazole

Mr. W

- Complains of chills
- Review of systems unremarkable:
  - No coughing, no sputum
  - No urinary tract symptoms
  - No abdominal pain, no diarrhea
  - No hematemesis, no melena
- Signs:
  - Blood pressure 100/70, pulse of 85/min, saturation of 98% (room air), mildly obtunded
  - No new murmur
  - Chest examination non-contributory
  - Abdomen soft, non-tender
  - No skin changes suggestive of cellulitis or endocarditis

Diagnostic tests

- Work-up for possible source of sepsis:
  - Chest X-ray: unchanged, no new infiltrate
  - Urinalysis and culture pristine
  - Gallium Scan: no evidence of recurrent gluteal abscesses
  - Transthoracic echocardiogram: no vegetations seen
  - Peripheral IV access removed
  - CT-scan of the abdomen ordered in search of an intra-abdominal source

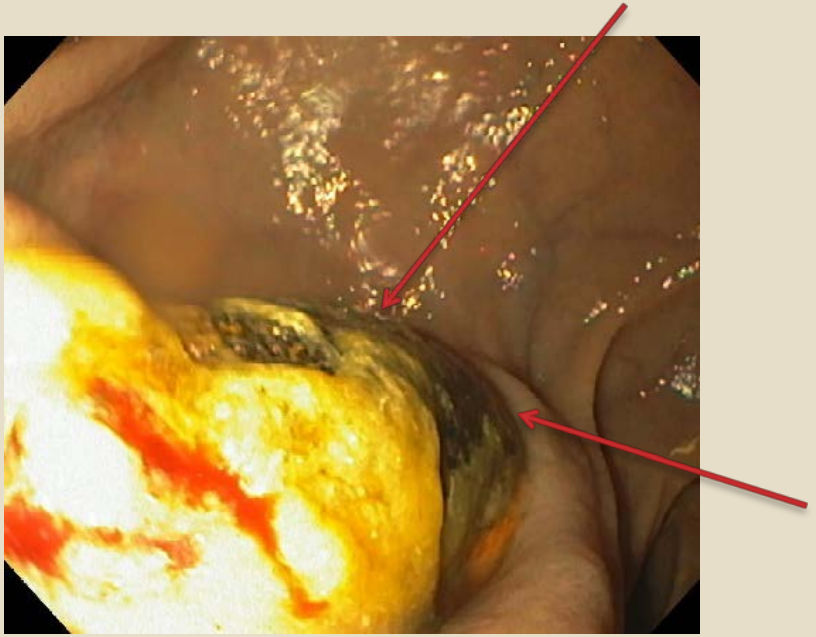
CT-scan of the abdomen

Report

- Tiny air bubble between the two limbs of the aorto-bifemoral graft just posterior to the third stage of the duodenum

- Gastroscopy is repeated

Gastroscopy: third part of the duodenum



Urgent vascular surgeries

- Urgent transfer to the ICU for hemodynamic monitoring
- Sent to the OR for a 2-step procedure:
  - Bilateral axillo-femoral bypass
  - Followed by resection of the infected graft and repair of the duodenum
- Discharged to rehabilitation center 3 months after day of admission

Objectives

1. Review the management of a patient with polymicrobial bacteremia: from identification of the source to treatment

2. Recognize the early warning signs of aorto-enteric erosion and fistula formation, as well as the impact of prompt therapeutic measures

Polymicrobial bacteremia

- Epidemiology:
  - Underreported, variable definition
  - Incidences of blood stream infections: 8 – 32 %
    - Polymicrobial 23% of all bacteremias (Ann Intern Med. 2002)
- Micro-organisms:
  - Community: *E. coli, S. pneumoniae*
  - Nosocomial: *S. aureus, S. epidermidis*, *Enterococcus*
- In-hospital Mortality:
  - Polymicrobial: 15-30% (Ann Intern Med, 2002)
  - *Pseudomonas*: 30.6% (Chest 2004)
  - VRE: 37.7% (Clin Infect Dis 2002)

Polymicrobial bacteremia

- Suggested workup:
  - Transthoracic echocardiogram: Endocarditis?
  - Endoscopy: Gastrointestinal lesion?
  - CT-scan of the abdomen: Urinary tract infection? Intestinal perforation? Hardware infection?
  - Abdominal ultrasound: Liver abscess?
  - Gallium scan: Osteomyelitis?
  - Dental examination: Abscess?

Aorto-enteric disease

- Aorto-enteric fistula:
  - Rare, life-threatening
  - Primary vs. secondary (aortic graft)
  - Highly-variable timing in the post-operative period

- Physiopathology:
  - Graft erodes trough enteric mucosa
  - Non-specific symptoms
  - Fistula forms: signs and symptoms of gastrointestinal bleeding (from sentinel bleed to massive hemorrhage)
  - Gram-negative rods involved in 50% cases, associated with a higher mortality

Aortoenteric erosion-fistula

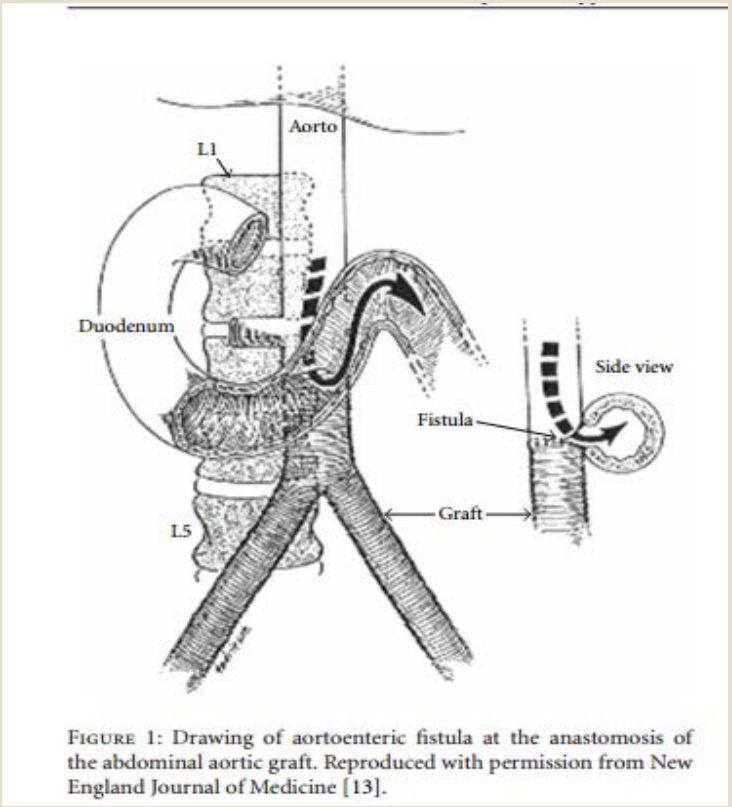


FIGURE 1: Drawing of aortoenteric fistula at the anastomosis of the abdominal aortic graft. Reproduced with permission from New England Journal of Medicine [13].

Case Rep Med. (2011), 2011:406730

Diagnosis: High index of suspicion in right clinical setting

- Diagnosis:
  - Unexplained fever, ileus
  - Leukocytosis
  - Blood Cx usually negative
  - Imaging : best to combine anatomical + functional
  - Endoscopy: ideally up to proximal jejunum

- Treatment:
  - Difficult to eradicate
  - Parenteral antibiotics: broad-spectrum ABx + IV vancomycin
  - Consider double-coverage for Pseudomonas
  - Explantation of device and ex-situ bypass
    - Mortality risk 20-30% (Rutherford textbook, 2014)

Key points

- Early recognition of these symptoms in a patient with prior aortic reconstruction surgery is key for source control.
- Sentinel bleeding may precede the massive hemorrhage of aorto-enteric fistula.
- Prompt therapeutic measures may avoid the disastrous presentation of aorto-enteric fistula.

References

- Textbooks:
  - Cronenwett, J. and Jonhston, W. *Rutherford's Vascular Surgery* (8th edition). Philadelphia: Saunders, April 2014.
  - Mandell, G. et al., *Principles and Practice of Infectious Diseases: Expert Consult Premium Edition* (7th edition). London: Churchill Livingstone, September 2009.
- Articles
  - Kenneth, V. et al, *Polymicrobial Infection in Patients with Cancer: An Underappreciated and Underreported Entity*. Clin Infect Dis. (2007) 45 (2):228-233
  - Friedman, D. et al., *Health care--associated bloodstream infections in adults: a reason to change the accepted definition of community-acquired infections.* Ann Intern Med. 2002;137(10):791-797.
  - Simon, T. et al., *Diverse Presentations of Secondary Aortoenteric Fistulae.* Case Rep Med. (2011), 2011:406730

Questions?

Incidence of Bacteremias

By type of infection

Table 3. **Source of Bloodstream Infection, by Epidemiologic Type of Infection***

Source of BSI	Patients with Community-Acquired BSI (n = 125)	Patients with Health Care–Associated BSI (n = 168)	Patients with Nosocomial BSI (n = 151)	*P* Values		
				Community-Acquired BSI vs. Health Care–Associated BSI	Community-Acquired BSI vs. Nosocomial BSI	Health Care–Associated BSI vs. Nosocomial BSI
	←	n (%)	→			
Intravascular device	0	70 (42)	78 (52)	NA	NA	>0.2
Urinary tract infection	58 (46)	29 (17)	27 (18)	<0.001	<0.001	>0.2
Pneumonia	34 (27)	27 (16)	24 (16)	0.10	0.18	>0.2
Gastrointestinal tract infection	5 (4)	28 (17)	20 (13)	0.004	0.056	0.15

* BSI = bloodstream infection; NA = not available.

Ann Intern Med. 2002;137(10):791-797.

Bacteremia-associated mortality

Table 3 Crude and adjusted risk of death within 0-2 days following hospital admission among inpatients who had one or more blood cultures taken within 2 days of hospital admission.

Blood culture status	n	0-2 days following admission		
		Mortality, % (95% CI)	Crude MRR (95% CI)	Adj. MRR* (95% CI)
Negative	26,625	2.0 (1.9-2.2)	1.0 (ref)	1.0 (ref)
Positive	2,648	4.8 (4.1-5.7)	2.2 (1.9-2.6)	1.9 (1.6-2.2)
Gram-positive	1,145	4.7 (3.6-6.1)	2.2 (1.7-2.8)	2.1 (1.6-2.7)
Gram-negative	1,340	4.4 (3.4-5.7)	1.9 (1.5-2.4)	1.5 (1.2-2.0)
Polymicrobial	160	9.2 (5.7-14.8)	4.6 (3.0-7.2)	3.5 (2.2-5.5)

*Adjusted for age, gender, level of comorbidity, marital status, and calendar period.

Table 4 Crude and adjusted risk of death within 3-7, 8-30, and 31-180 days following hospital admission among inpatients with one or more blood cultures taken within 2 days of hospital admission.

Blood culture status	3-7** days following admission			8-30 days following admission†			31-180 days following admission‡		
	Mortality, % (95% CI)	Crude MRR (95% CI)	Adj. MRR* (95% CI)	Mortality, % (95% CI)	Crude MRR (95% CI)	Adj. MRR* (95% CI)	Mortality, % (95% CI)	Crude MRR (95% CI)	Adj. MRR* (95% CI)
Negative	2.7 (2.5-2.9)	1.0 (ref)	1.0 (ref)	5.1 (4.9-5.4)	1.0 (ref)	1.0 (ref)	8.7 (8.3-9.0)	1.0 (ref)	1.0 (ref)
Positive	3.7 (3.1-4.6)	1.3 (1.1-1.7)	1.1 (0.9-1.5)	5.6 (4.8-6.6)	1.1 (0.9-1.3)	0.9 (0.8-1.1)	9.7 (8.6-11.0)	1.1 (1.0-1.3)	1.0 (0.8-1.1)
Gram-positive	4.5 (3.4-5.9)	1.7 (1.3-2.4)	1.7 (1.2-2.3)	6.0 (4.7-7.6)	1.1 (0.9-1.5)	1.1 (0.8-1.4)	9.6 (7.9-11.6)	1.1 (0.9-1.4)	1.0 (0.8-1.3)
Gram-negative	2.7 (1.9-3.7)	1.0 (0.7-1.4)	0.8 (0.5-1.1)	5.2 (4.1-6.6)	1.0 (0.8-1.3)	0.8 (0.6-1.0)	9.3 (7.8-11.1)	1.1 (0.9-1.3)	0.9 (0.7-1.0)
Polymicrobial	7.4 (4.2-13.0)	1.9 (0.8-4.2)	1.4 (0.6-3.1)	6.6 (3.5-12.2)	1.5 (0.8-2.8)	1.1 (0.6-2.1)	14.8 (9.7-22.3)	1.7 (1.1-2.8)	1.3 (0.8-2.1)

*Adjusted for age, gender, level of comorbidity, marital status, and calendar period.

** For patients alive on day 3

†For patients alive on day 8.

‡For patients alive on day 31.

Søgaard et al. BMC Infectious Diseases 2011, 11:139