Midbrain MAGIC

CID conference
Hunter Ratliff
10/03/2024

Ages, dates, and other identifying information may have been changed
I have no conflict of interest in relation to this presentation

Case #1

Case 1: HPI

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- Admit to NSGY
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- Hospital day 2: only A&Ox2
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  - Repeat CTH stable
- Hospital day 3: Worsened mental status
  - Sent infectious workup (UA/UCx, BCx)
  - Started Vanco / Cefepime / Flagyl
  - Obtained MRI

Case 1: Initial workup

Vitals: Normal, bit hypertensive

Neuro exam: Normal (at first)

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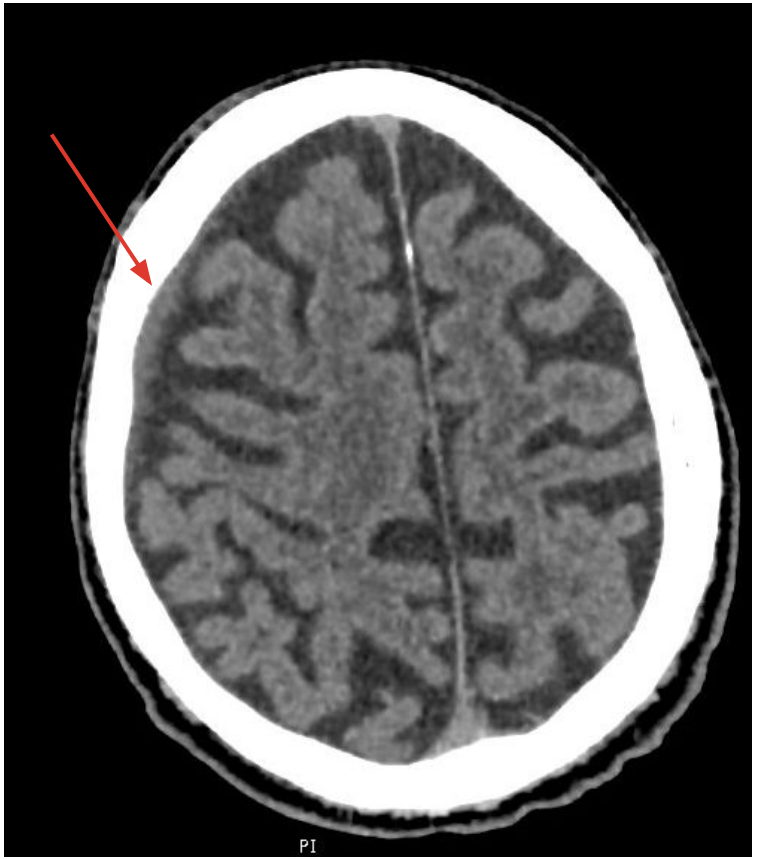
CTH: 4mm right frontal SDH



Case 1: Initial workup

Vitals: Normal, bit hypertensive

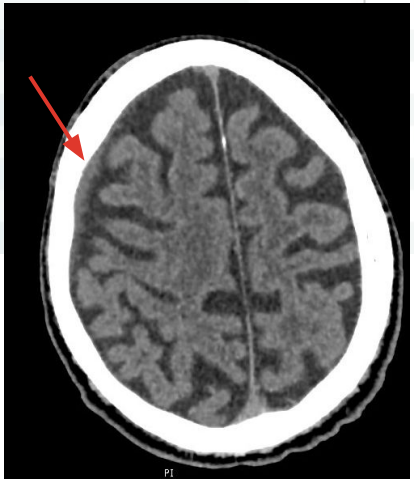
Neuro exam: Normal (at first)

CTH: 4mm right frontal SDH

A1c: 9.8

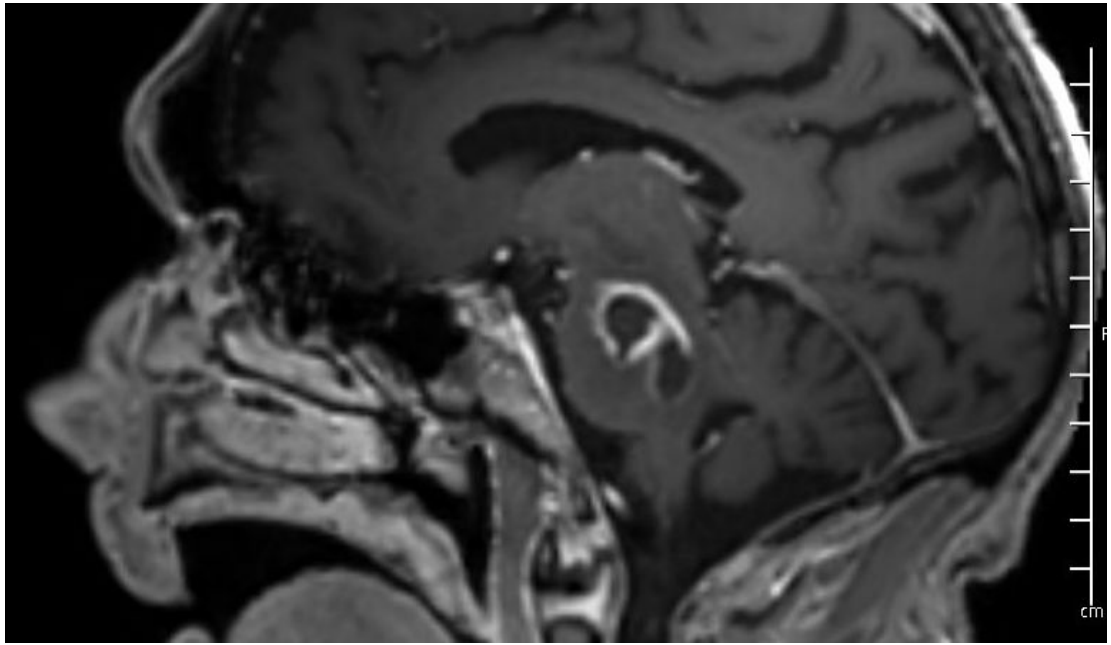
HIV screen: not obtained

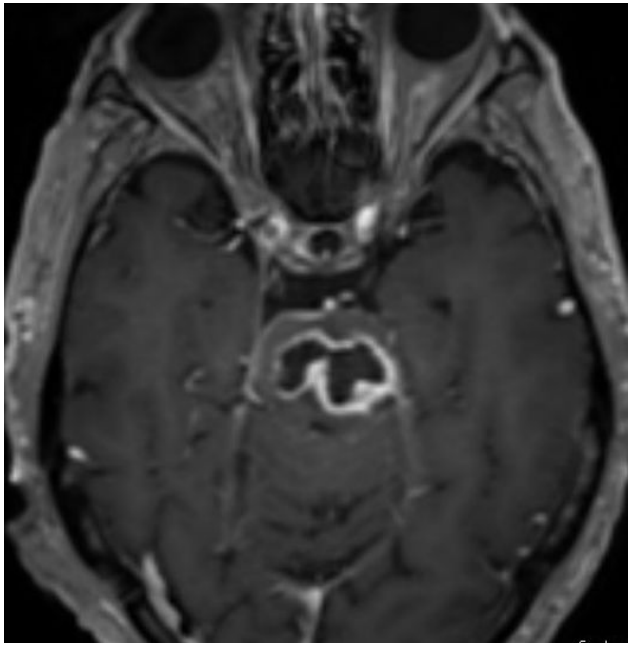
24 hrs:	Admit	HD1	HD2	HD3
Hematology				
WBC	9.3		17.2	
RBC	4.46		4.69	
HGB	14.0		14.6	
HCT	40.7		43.0	
PLC	318		321	
MCV	91.3		91.7	
Chemistry				
Sodium	131		132	131
Potassium	4.4		4.5	
Chloride	99		100	
CO2	20		20	
BUN	38		29	
Creatinine	1.97		1.55	
Calcium	9.6		9.7	
Magnesium			1.9	
Phosphorus			3.1	



Case 1: MRI

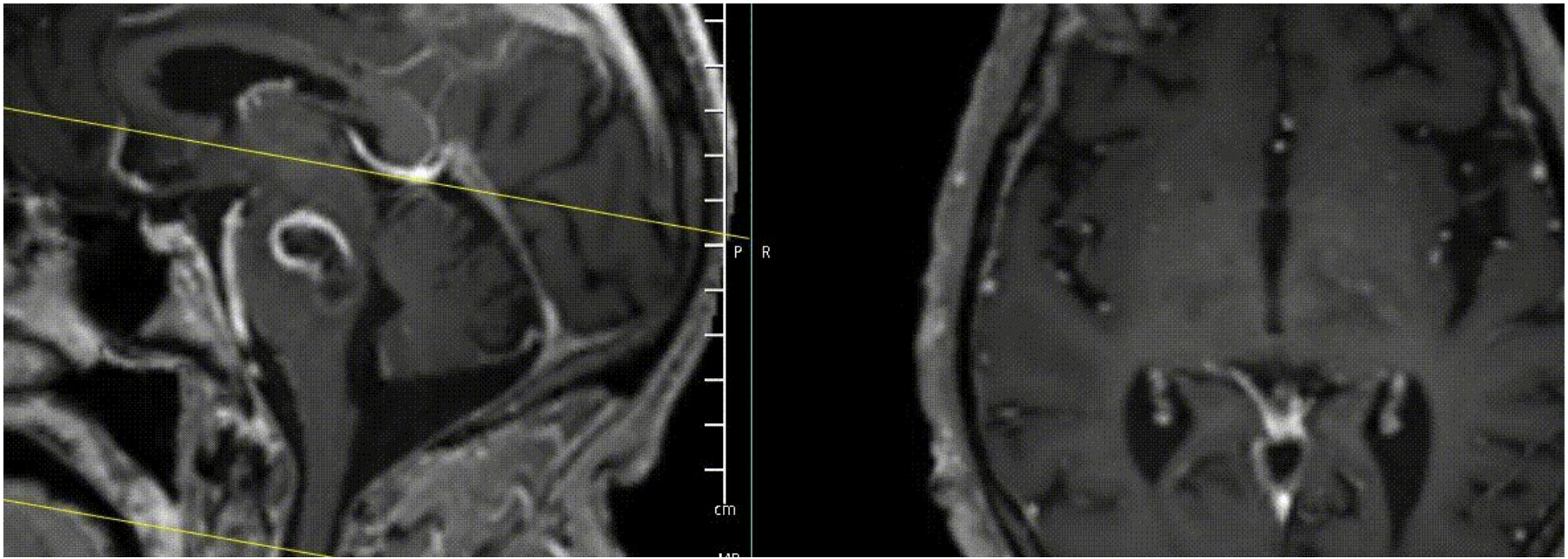
Rim-enhancing lesion seen within the **pons** with associated internal restricted diffusion measuring up to **2.9 x 1.6 cm**. On coronal post contrast sequences, there is ringlike enhancement seen along the **left cortical spinal tract**, with questionable restricted diffusion. There is **extensive edema seen along the pons and midbrain**. There is mass effect on the fourth ventricle **without complete effacement** or hydrocephalus.





T2 post contrast sequences

Case 1: MRI



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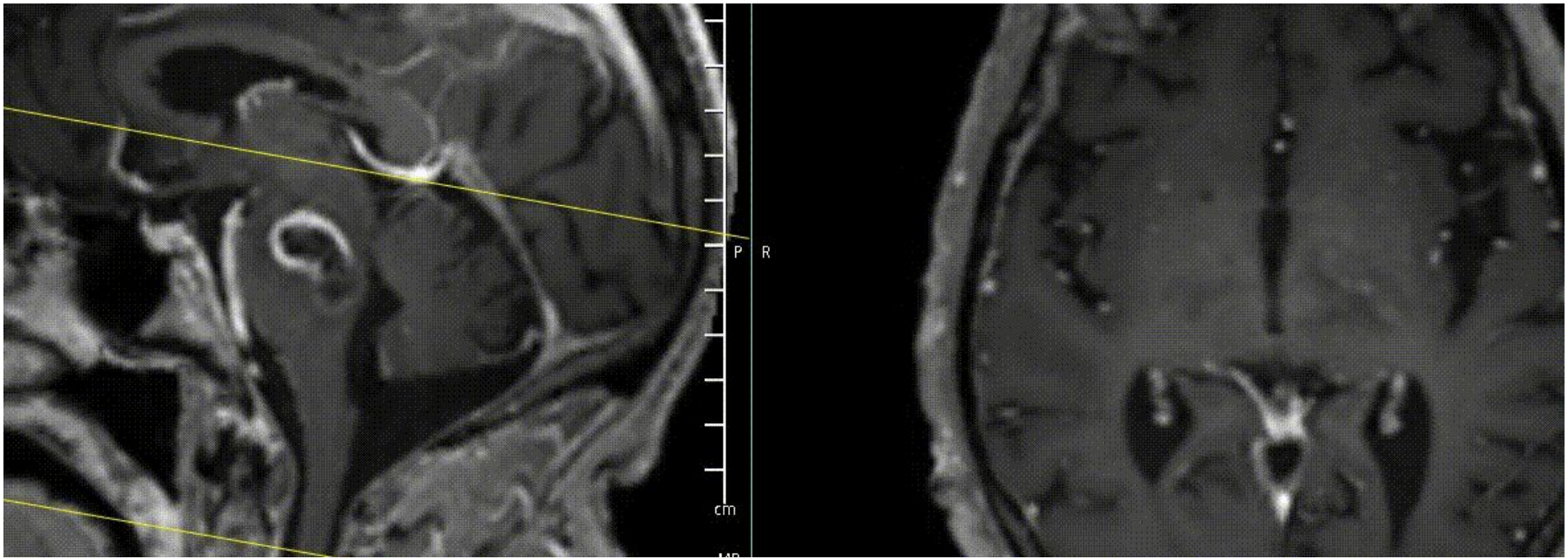
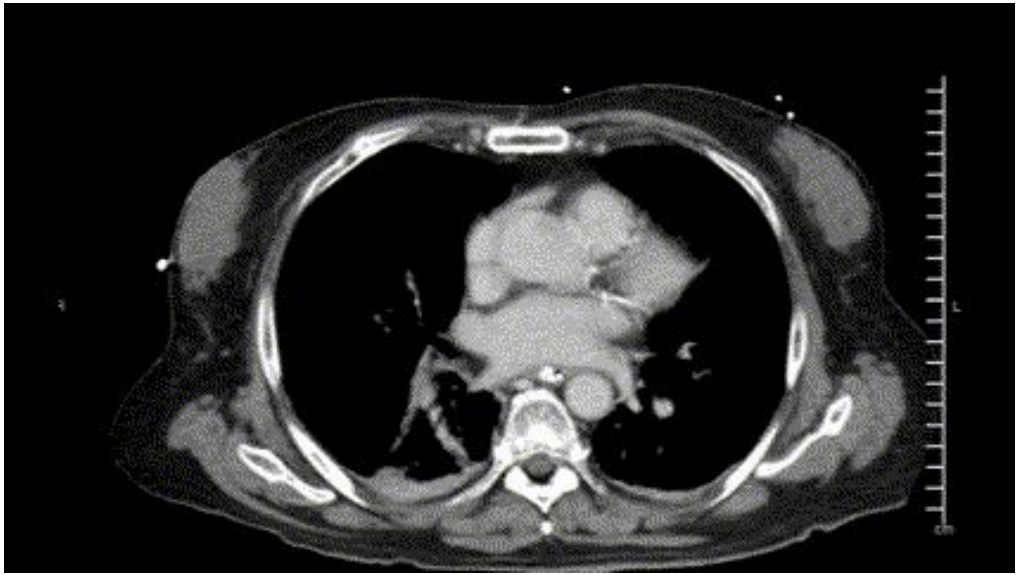


T2 post contrast sequences

Case 1: Additional imaging

Due to concern for malignancy (glioma), CT C/A/P was obtained

CT C/A/P: Multiple ill-defined low-attenuation areas within the liver, which may be due to heterogeneous fatty infiltration, hepatocellular carcinoma or metastatic disease. MRI with liver mass protocol is recommended for further evaluation. Incompletely characterized on this study.

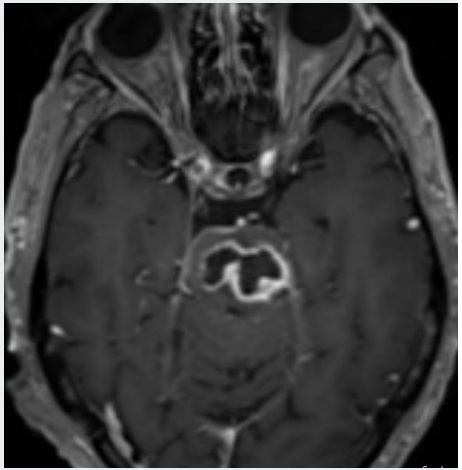


Case 1: Summary

A **73 y/o M** with **unclear PMH** p/w **falls** headache, slurred speech x7 days

- **A1c**: 9.8
- **MRI**: 3cm pontine rim enhancing lesion. extensive edema in pons and midbrain. mass effect on the fourth ventricle

Liver hypoattenuation
(incompletely characterized)



-7 d — **Falls**
headache, slurred speech per EMR

Admit — **Admitted to NSGY**

Day 2 — **Only A&Ox2**
WBC 9 → 17

Day 3 — **Worsened mental status**
- MRI: 2.9 x 1.6 cm rim enhancing pontine lesion with edema
- Started VAN / FEP/ MTZ

Day 4 — **OR for aspiration → NCCU**
Intubated after OR in NCCU

Day 5 — **ID consulted**

Case 1: Hospital course

- Blood cultures positive for ***Listeria monocytogenes*** (prior to ID consult)
  - Advised NCCU to start ampicillin
  - OR cultures unsurprisingly grew Listeria as well
- Still intubated when we signed off but…

Subjective: No rash. No report of diarrhea. Was able to follow some commands for me today. Seem to endorse head nod "yes" and I inquire about eating lunch meat. Yes for ham and liverwurst. No for turkey. Patient indicated he was not in pain.

- Discharged on **Ampicillin x 6 weeks**

Discussion

Links to articles discussed here

Listeriosis

Objectives

- Review **trends in recent foodborne illnesses**, with a focus on **Listeria & recent outbreaks**
- Examine why Listeria is unique from other foodborne pathogens
- Describe clinical manifestations & treatment

Foodborne illnesses

- Over 200 known diseases capable of infecting humans via food / food products
- Despite safety improvements, rates have been **increasing in the US** [1.1]
    - More complex food supply chains
    - Increasing demands → intensive farming
    - Climate change
    - Improved testing & reporting

Foodborne illnesses

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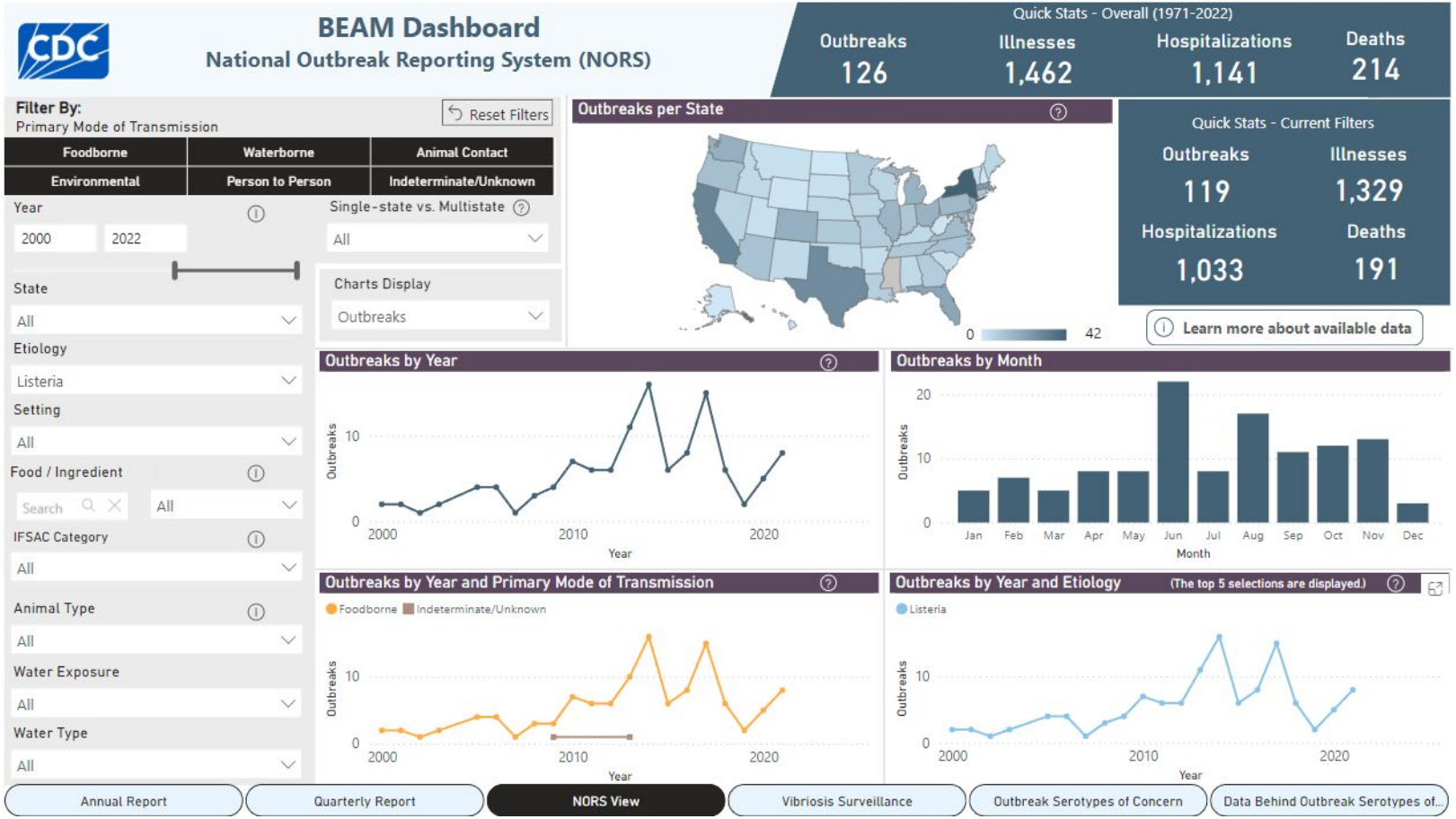
- Common pathogens
  - Norovirus (58%)
  - Nontyphoidal Salmonella species (11%)
  - Campylobacter spp. (9%)
  - E coli
  - **Listeria monocytogenes** (1%)



NORS (2000-2022) Listeria outbreaks [3.2]

Prior outbreaks of Listeria [3.3]

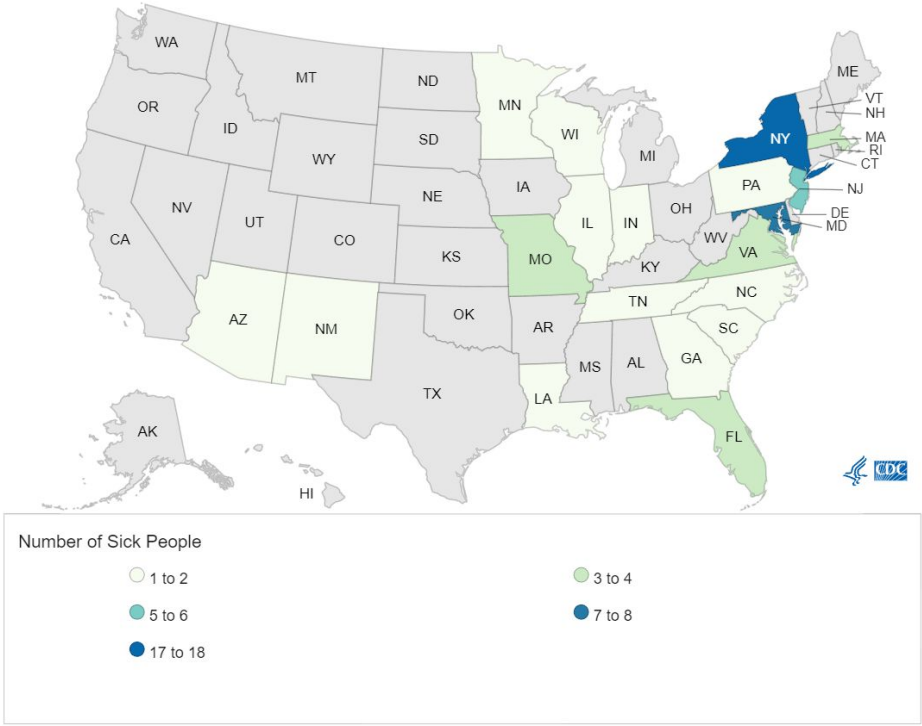
- 1985: **Mexican cheese** (**52 deaths**, over **half were stillbirths/infants**)
- 1998: **Hot dogs & cold cuts** (**14 deaths**, **4 miscarriages**)
- 2002: **27 million pounds** of **turkey** recalled (**46 hospitalizations**, **7 deaths**, 3 miscarriages)
- 2007: **Two deaths** from **contaminated milk**
- 2011: Outbreak from **cantaloupes** (**30 deaths**). **Spinach dip & salad bags** were recalled separately
- 2015: Large recall of contaminated **organic spinach**
- 2016: **Frozen food products** from 40 different brands recalled (**8 cases**)
- 2018: Recall of **organic nut mix**
- 2023: **Milkshakes** (**6 hospitalized**, **3 deaths**)
- 2024: Current outbreak (**59 cases**, **10 deaths**)

Current outbreak [3.1]

As of 9/23/24 (the last CDC update)*

- **59 cases** across **19 states**
  - **10 deaths**
- Ages range from 32 to 95 years (**median 78**)
- **94%** reported eating **deli meats**
  - 95% reported eating meats sliced at a deli
- Of the 44 people who answered if they ate liverwurst, 26 (**59%**) reported **deli-sliced liverwurst** before getting sick, and 19 reported Boar's Head brand

* Cases are from 5/29 - 8/28/24, sense it takes CDC time to do their work. So if this case was associated with this outbreak, it wouldn't have shown up yet



[3.4] CDC map from 2024 outbreak (accessed 10/1/24)

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- Examine **why Listeria is unique** from other foodborne pathogens
- Describe clinical manifestations & treatment

Listeria: Microbiology

- Small **intracellular** gram positive bacillus often in chains
  - Non-motile at 37°C but has **tumbling motility** at 22-25°C
  - Grows best on blood agar & tryptose phosphate agar
- Isolated from milk & cheese products, meat

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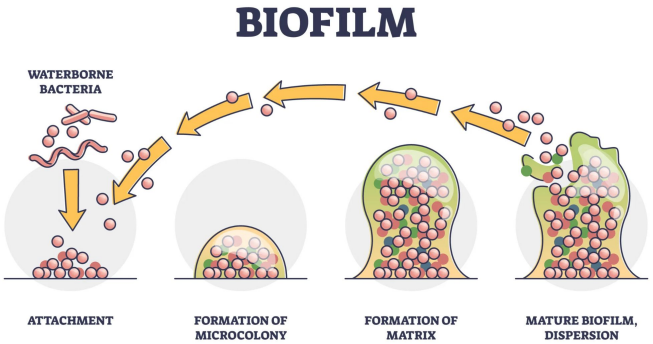
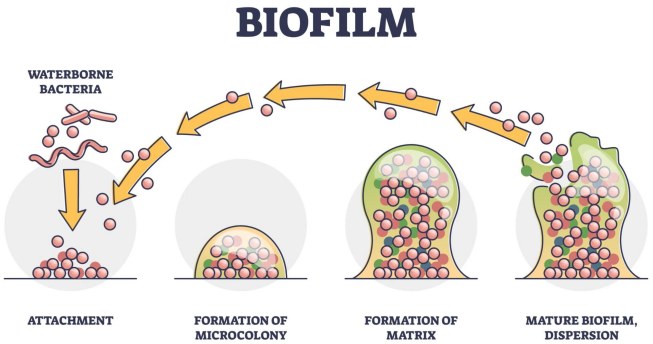


- Unique in that it can survive harsh conditions, in large part due to **biofilm production** [1.2]
  - Low temperatures (−0.4 to 50 °C) and pH (4.6–9.5)
  - High salt concentrations (10–2%)
  - Low water concentrations

Listeria: Microbiology



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  - Low temperatures (−0.4 to 50 °C) and pH (4.6–9.5)
  - High salt concentrations (10–2%)
  - Low water concentrations
- Biofilm production is linked to:
  - **Temperature**: Low temp → increased flagella activity → increased biofilm
  - **Nutrient availability**: Being on stainless steel increases biofilm production
- Biofilm production makes it **harder for disinfectants to work**

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Listeria: Transmission

Transmission

- Gastrointestinal → blood stream
- Vertical: Maternal GI → hematogenous to fetus
- **Low infectious dose** (~100 bacteria) needed to infect immunocompromised

Incubation period has wide variety (3 days to **10 weeks**) [3.1]

Listeria: Transmission & manifestations

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- **Low infectious dose** (~100 bacteria) needed to infect immunocompromised

Incubation period has wide variety (3 days to **10 weeks**) [3.1]

- **Limited febrile gastroenteritis**: Mainly in immunocompetent
- **Invasive listeriosis**: Mainly in immunocompromised
  - Bloodstream infection with sepsis w/ meningitis
  - High mortality (~25%)
- **Pregnancy**: Usually mild illness for the mother, but can cause preterm labor, fetal sepsis, and fetal demise

Basilar CNS infection

DDx of basilar meningitis / abscesses [1.3] [3.5] [Guilfoose]

- **Tuberculosis**
- **Fungal**: Crypto, histo
- **Spirochetes**: Lyme, syphilis
- **Listeria**
- **Granulomatous disease**
- **Neurosarcoidosis**, leptomeningeal carcinomatosis, lymphoma

Some association with these infections and CN palsy & increased ICP [3.5]

Listeria: Treatment

Ampicillin, penicillin, gentamicin and TMP-SMX are active

- Inherently resistant to cephalosporins
- **Ampicillin** is the drug of choice
- Mixed reports on if meropenem can be used for meningitis

Case #2

Case 2: HPI

A **65 y/o F** with PMH including PAD (left ax-SFA bypass 12/2019, left AKA 8/2021), s/p CABG, CVA, DVT, chronic sacral decubitus ulcer, rectovaginal fistula s/p diverting colostomy, chronic SPC p/w **bleeding from her graft**.

Case 2: HPI

A **65 y/o F** with PMH including PAD (left ax-SFA bypass 12/2019, left AKA 8/2021), s/p CABG, CVA, DVT, chronic sacral decubitus ulcer, rectovaginal fistula s/p diverting colostomy, chronic SPC p/w **bleeding from her graft**.

- Sent from vascular clinic for exposed graft on left chest that has been bleeding for weeks/months
- Mostly bloody but occasionally purulent on her anterior chest wall
- No antibiotics prior to admission

Case 2: Background

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2006	2019	2021	2023	2024
Endometrial cancer s/p hysterectomy Recurred in 2009 and required XRT	**Left Ax-SFA Bypass** (Teflon) Placed for radiation-induced ischemia to left common/external iliac arteries	**Left AKA** for graft occlusion **& sacral wound** VRE UTI 1 month later treated for AKA stump infection & sacral wound	**SBO, MRSA bacteremia** Treated w/ 6 weeks of dapto	**Bleeding from graft** Sent from vascular clinic, unclear chronicity

Case 2: HPI

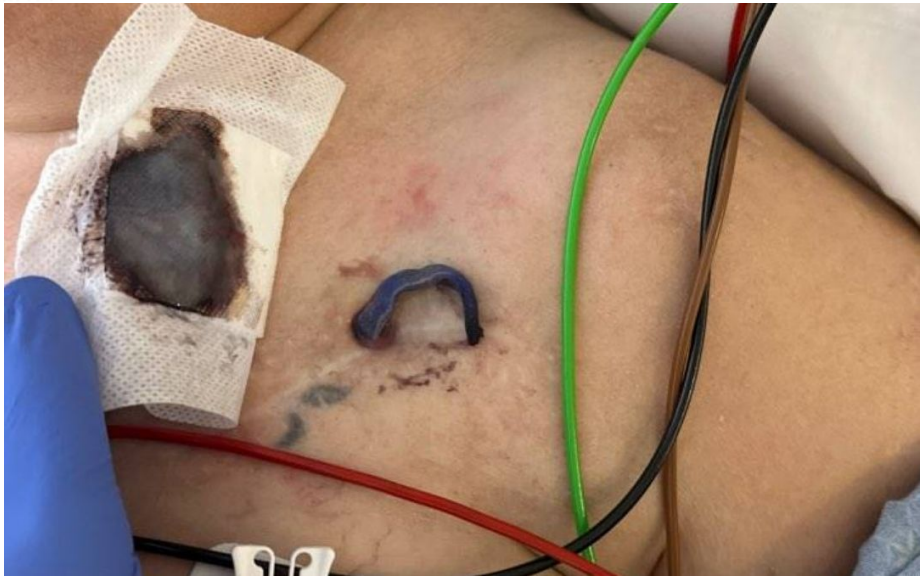
Social History, Exposures, Risk Factors

Geographic & Occupational: The patient lives in Westernport, West Virginia in a nursing facility. She denies recent travel.
Substance: They deny alcohol use and she does not use tobacco . They report no recreational drug use
Environmental exposures: No outdoor exposures
Animal Exposures: The patient denies farm animal exposures or other animal exposure (including pets).
Infectious PMH: They report previous intolerances/allergies to antimicrobials (**bactrim caused nausea**; has tolerated amoxicillin in the past); she denies recent antimicrobial use. They deny history of C. diff infections.

Case 2: Exam

PHYSICAL EXAM

Vitals: BP 138/67 | Pulse 66 | Temp 36.7 °C (98 °F) | Resp 12 | Wt 105 kg (231 lb 7.7 oz) | SpO2 95% | BMI 42.34 kg/m²
Gen: alert and oriented, NAD, vitals reviewed
Head/Neck: NCAT; trachea appears midline, no gross LAD
ENT: EOMI grossly, anicteric sclerae; MMM
Resp: normal respiratory effort, symmetric chest rise
CV: RRR; extremities perfused
GI: non-distended; no TTP
Ext: s/p L AKA, RLE perfused
Skin: Wounds not examined
Neuro/MSK: moves extremities
Psych: normal mood; appropriate affect



Case 2: Initial Workup

CTA C/A/P: Inflammatory changes are noted surrounding proximal remnant of the left axillary-femoral bypass graft with **trace foci of air seen adjacent to graft** in left upper chest. No flow is seen within the graft. Multifocal atherosclerotic disease. The SMA, celiac artery, bilateral renal arteries are patent. Occlusion of the left common/external/internal iliac arteries and proximal aspect of the left common femoral artery as well as the left superficial femoral artery.

WBC	3.7 - 11.0 x10^3/uL	13.4 ^
RBC	3.85 - 5.22 x10^6/uL	4.10
HGB	11.5 - 16.0 g/dL	9.7 v
HCT	34.8 - 46.0 %	32.6 v
MCV	78.0 - 100.0 fL	79.5
MCH	26.0 - 32.0 pg	23.7 v
MCHC	31.0 - 35.5 g/dL	29.8 v
RDW-CV	11.5 - 15.5 %	14.7
PLATELETS	150 - 400 x10^3/uL	348
MPV	8.7 - 12.5 fL	10.5
NEUTROPHIL %	%	75.9

Case 2: Operative Note

Left axillary artery cutdown with explant of previous bypass graft with primary repair of left axillary artery

Findings: Purulence found in the previous axillary to femoral bypass graft tract distal to the anastomosis. The area near the anastomosis was well incorporated and did not appear to be infected. Post resection of the bypass graft and over-sewing of the anastomosis images revealed a patent axillary artery with no significant stenosis.

Implants: None

The incision was made over the area of the wound. **The bypass graft was found and the distal portion was easily removed from its tract due to significant perigraft purulence**. **Cultures were taken**. We continued our dissection distal to the graft and identified the axillary artery distal to the anastomosis. The artery was then controlled with silastic vessel loops.

We then dissected around the graft to the level of the anastomosis. The graft was well incorporated proximally and dissection was difficult. **The anastomosis did not appear to be infected and appeared to be well incorporated.** The graft was then transected 2-3 mm above the anastomosis. Using a 4 0 Prolene suture the graft and surrounding tissue were oversewn in 2 layers. **Cultures were taken at the level of the anastomotic stump.**

Using a curette the graft tract was debrided in the chest wall. **A counter incision was made in the lateral chest wall at the level of the distal graft site.** A 2nd incision was made inferior to our axillary wound. Using a DeBakey vascular clamp a **Penrose drain was passed between these 2 incisions in the tract of the previous bypass graft** and secured. The wound was then irrigated. A 14 French flat JP drain was placed in the deep space above the arterial repair. Using a 2-0 Vicryl suture the deep layer was closed in an interrupted fashion.

Case 2: Summary

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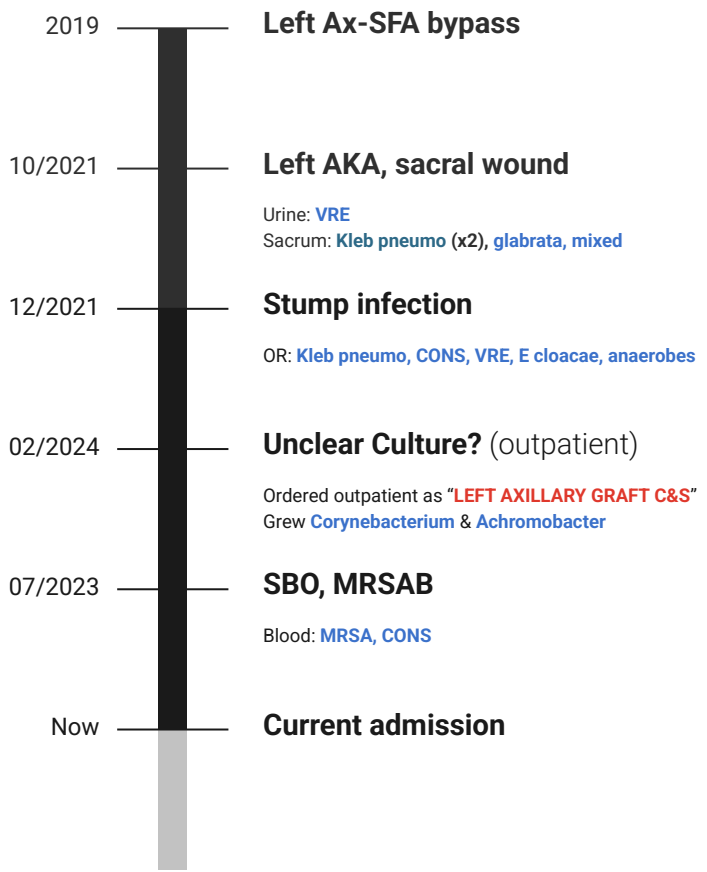

Micro data

BCx: **NGTD**

OR (L axillary artery): **Proteus mirabilis** (<5 cfu)

OR (Left Axillary Incision wound):

	Proteus mirabilis MIC	SUSCEPTIBILITY
Amikacin	<=2 mcg/mL	Sensitive
Amoxicillin/clauvulanate	<=2 mcg/mL	Sensitive
Ampicillin	<=2 mcg/mL	Sensitive
Cefepime	<=1 mcg/mL	Sensitive
Ceftazidime	<=1 mcg/mL	Sensitive
Ceftriaxone	<=1 mcg/mL	Sensitive
Ciprofloxacin	1 mcg/mL	Resistant
Ertapenem	<=0.5 mcg/mL	Sensitive
Gentamicin	<=1 mcg/mL	Sensitive
Levofloxacin	1 mcg/mL	Intermediate
Meropenem	<=0.25 mcg/mL	Sensitive
Piperacillin/Tazobactam	<=4 mcg/mL	Sensitive
Tetracycline		Resistant
Tobramycin	<=1 mcg/mL	Sensitive
Trimethoprim/Sulfamethoxazole	<=20 mcg/mL	Sensitive

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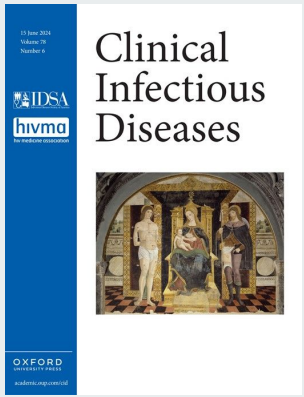
Case 2: Hospital course

- Initially on Vanc & Zosyn
- Switched to ceftriaxone by ID
- AKI on CKD, required some CRRT post op
- Discharged on Augmentin
    - Plans to suppress since some graft still in place

Discussion

Links to articles discussed here

Vascular Graft Infections (VGI)



DeSimone et al (2024)
Clinical Infectious Diseases
[citation 2.1]

Objectives

- **Accurately diagnose & categorize** (suspected & confirmed) **VGIs**
- Describe surgical management
- Review treatment options & duration

Table 1. A Case Definition for Vascular Graft Infection of the Management of Aortic Graft Infection Collaboration (MAGIC)

	Clinical/Surgical	Radiography	Laboratory[a]
Major criteria	1. Purulence (confirmed by microscopy) around graft or in aneurysm sac during surgery[b] 2. Open wound with exposed graft or communicating sinus tract 3. Fistula development (eg, aortoenteric) 4. Graft insertion in an infected site (eg, fistula, mycotic aneurysm, or infected pseudoaneurysm)	1. Perigraft fluid on CT scan ≥3 mo after insertion 2. Perigraft gas on CT scan ≥7 wk after insertion 3. An increase in perigraft gas volume demonstrated on serial imaging	1. Organisms recovered from an explanted graft 2. Organisms recovered from an intraoperative specimen 3. Organism recovered from a percutaneous aspirate of perigraft fluid
Minor criteria	1. Localized clinical features of VGI (eg, erythema, warmth, swelling, purulent discharge, and pain) 2. Fever ≥38°C with VGI as most likely cause	1. Other (eg, suspicious perigraft gas/fluid/soft tissue inflammation; aneurysm expansion; pseudo-aneurysm formation; focal bowel wall thickening; discitis/osteomyelitis; suspicious metabolic activity on FDG PET/CT; radiolabeled leucocyte uptake)	1. Blood culture(s) positive and no apparent source except for VGI 2. Abnormally elevated inflammatory markers with VGI as the most likely cause (eg, ESR, CRP, and white blood cell count)

✨MAGIC✨
Management of Aortic Graft Infection Collaboration 🪄

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Minor criteria	1. Localized clinical features of VGI (eg, erythema, warmth, swelling, purulent discharge, and pain) 2. Fever ≥38°C with VGI as most likely cause	1. Other (eg, suspicious perigraft gas/fluid/soft tissue inflammation; aneurysm expansion; pseudo-aneurysm formation; focal bowel wall thickening; discitis/osteomyelitis; suspicious metabolic activity on FDG PET/CT; radiolabeled leucocyte uptake)	1. Blood culture(s) positive and no apparent source except for VGI 2. Abnormally elevated inflammatory markers with VGI as the most likely cause (eg, ESR, CRP, and white blood cell count)

Suspected VGI
One major **– or –**
Minor from 2 of 3 categories

Confirmed VGI
One major **– plus –** any other criterion (major or minor) from another category

VGI: Diagnosis

Radiological criteria

- CTA is the main stay
- Perigraft gas/fluid after 2-3 months are highly suggestive of VGI
- WBC scintigraphy & PET/CT are best
    - Meta-analysis [2.2] showed WBC SPECT/CT out performed FDG-PET/CT

Laboratory criteria

- 2/3rd of cases are gram positive (CONS, SA, enterococci) ,1/3rd are gram negative
- Often negative due to antibiotics
    - May be some role for 16S rRNA or broad-range bacterial-PCR

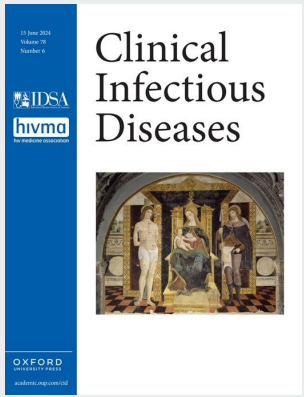
VGI: Extent of infection

Samson classification: distinguishes between infection limited to skin and soft tissue vs. reaching vascular prosthesis

- **Group I**: Infection limited to dermis
- **Group II**: Infection of subcutaneous tissue without direct contact with the graft
- **Group III**: Infection reaching body of the graft but not anastomosis
- **Group IV**: Exposed anastomosis, no bleeding, no bloodstream infection
- **Group V**: Anastomosis involved, bleeding, bloodstream infection

VGI

Vascular Graft Infections (VGI)

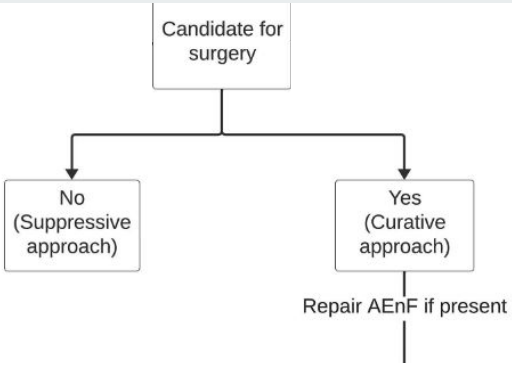


DeSimone et al (2024)
Clinical Infectious Diseases
[citation 2.1]

Objectives

- Accurately diagnose & categorize (suspected & confirmed) VGIs
- **Describe surgical management**
- Review treatment options & duration

VGI: Surgical management



Graft explant should be done, if a candidate

- 18-30% mortality w/ graft explant
- 2 year mortality approaches 100% if not explanted

The authors consider *partial explant* to be conservative/suppressive approach

VGI: Surgical management

Graft explant should be done, if a candidate

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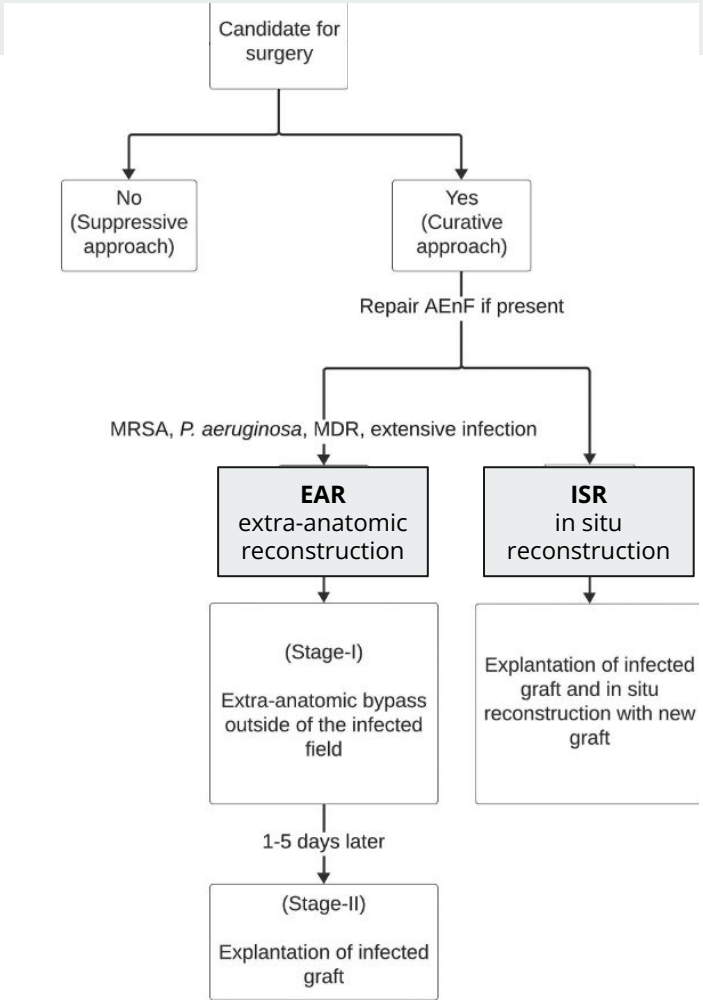
The authors consider *partial explant* to be conservative/suppressive approach

- ISR is now preferred technique early mortality, amputations, graft occlusion, and overall reinfection
- EAR may be preferred for difficult-to-treat pathogens or presence of extensive perigraft infection to avoid reconstruction in a heavily contaminated field



VGI: Extent of infection

Samson classification: distinguishes between infection limited to skin and soft tissue vs. reaching vascular prosthesis

High risk of VGI

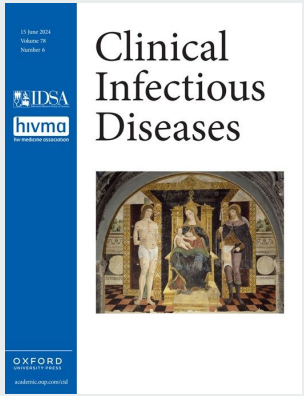
- **Group I**: Infection limited to dermis
- **Group II**: Infection of subcutaneous tissue without direct contact with the graft

VGI

- **Group III**: Infection reaching body of the graft but not anastomosis
- **Group IV**: Exposed anastomosis, no bleeding, no bloodstream infection
- **Group V**: **Anastomosis involved**, bleeding, bloodstream infection

Must be explanted (no “conservative management”)

Vascular Graft Infections (VGI)



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Objectives

- Accurately diagnose & categorize (suspected & confirmed) VGIs
- Describe surgical management
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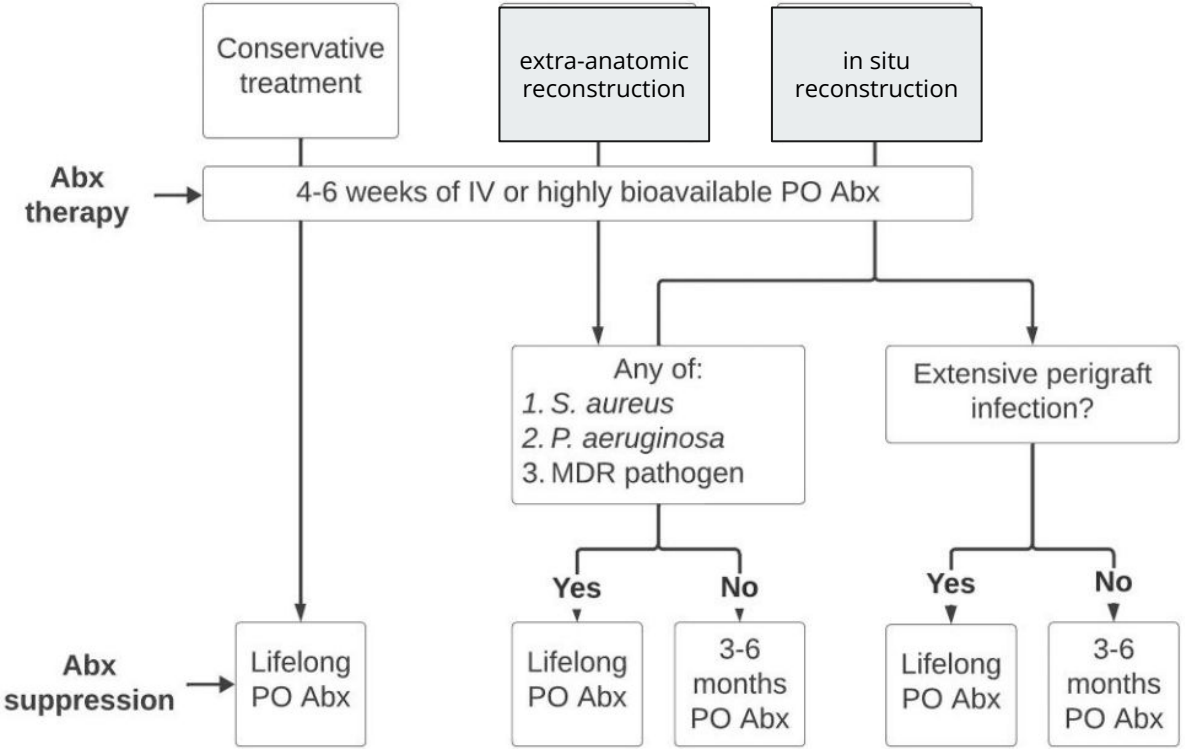
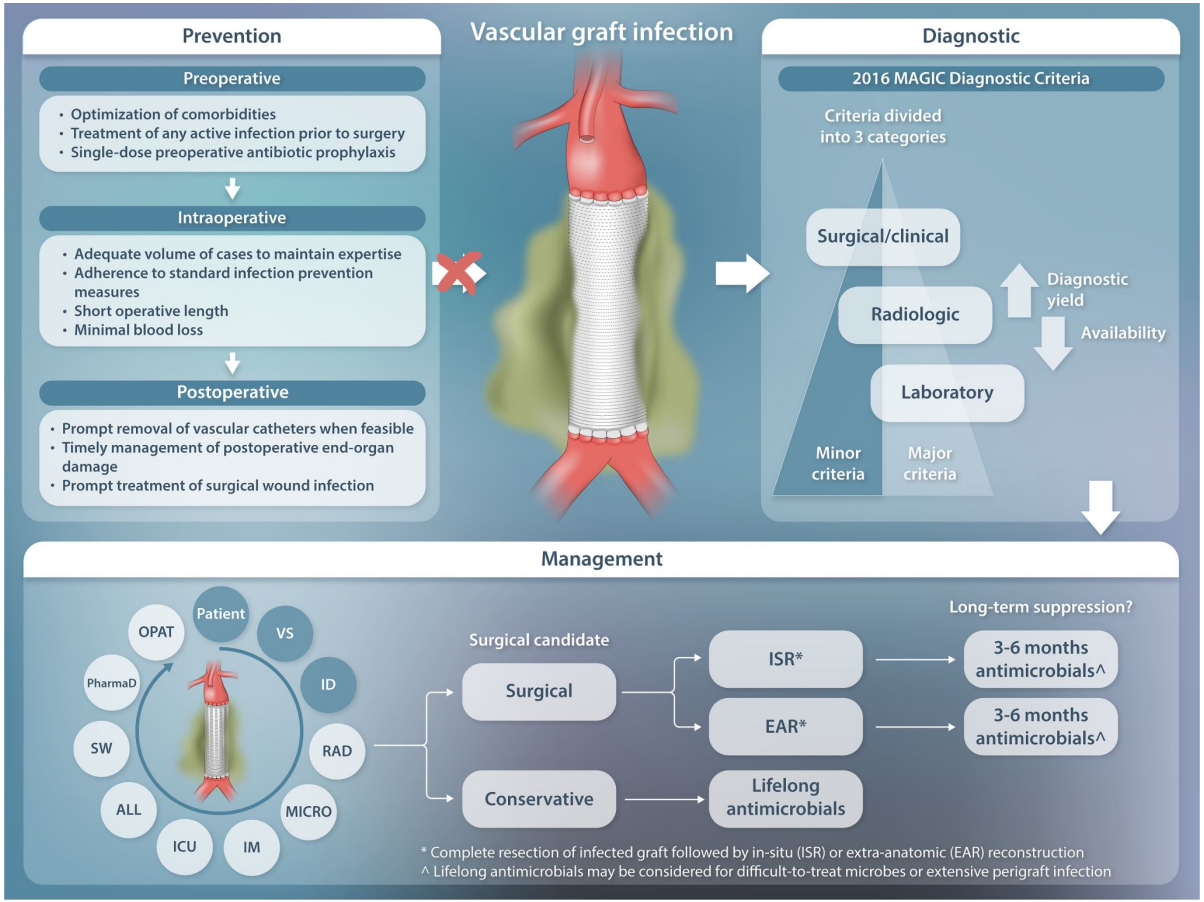
VGI: Duration of treatment





DeSimone et al (CID, 2024)

Learning points & take aways

Learning points & take aways

- Rates of **foodborne illness** have been **increasing due to multiple factors** (supply chain, intensive farming, climate change, improved surveillance)
- **Listeria** is an uncommon, but deadly foodborne pathogen in part due to **biofilm production**
- **Basilar CNS infections** are associated with **listeriosis**, in addition to **TB**, **fungal**, **spirochetes**, & other **granulomatous processes**

- **Vascular graft infections** (VGI) are defined & classified by the **MAGIC criteria**🪄 & **Samson classification**, respectively
- **Lifelong antibiotics** may be needed for VGIs, depending on **surgical approach** (*extra-anatomic* vs *in situ* reconstruction), the **pathogen identified**, and **extent of infection**

Slides available on hunterratliff1.com/talk/; Citations available via QR code or via the "citations" button on the website