Today's Challenges in Vascular Access

- leading cause of hospitalization in the ESRD population (Feldman et al., 1993)
- annual cost approaching $1 billion (Feldman et al., 1996)
- aging population with diabetes as the leading cause of ESRD
- our patients need an access that works better and lasts longer
- WITH LESS PAIN AND SUFFERING!!!

Pros and Cons of Catheter Access

- **pro** - no cannulation
  - can be dialyzed immediately
  - allows for long-term fistula maturation
- **con** - high risk of bacteremia
  - endothelial damage/risk of central vessel occlusion
  - ?lower flow volume (through dialyzer ml/min)
  - fibrin sheath formation
  - cannot shower/swim

- **Temporary catheters**
- 3 weeks or less

- Acute renal failure
- Maturing AV access
- Intoxication
- Plasmapheresis
- Volume control

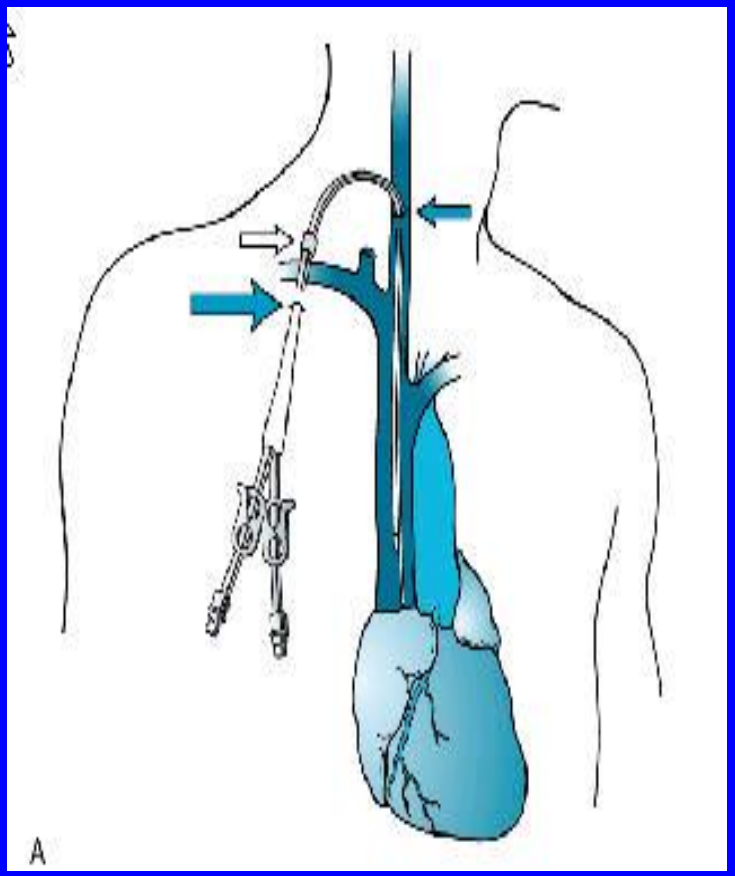
- **Chronic catheters**
- 3 weeks or more tunneled cuffed

- Same as temporary catheters
- Maturation of PD access
- Maturing AV access
- Failure of AV access
- Bridge followibg infection and removal of access

Catheters

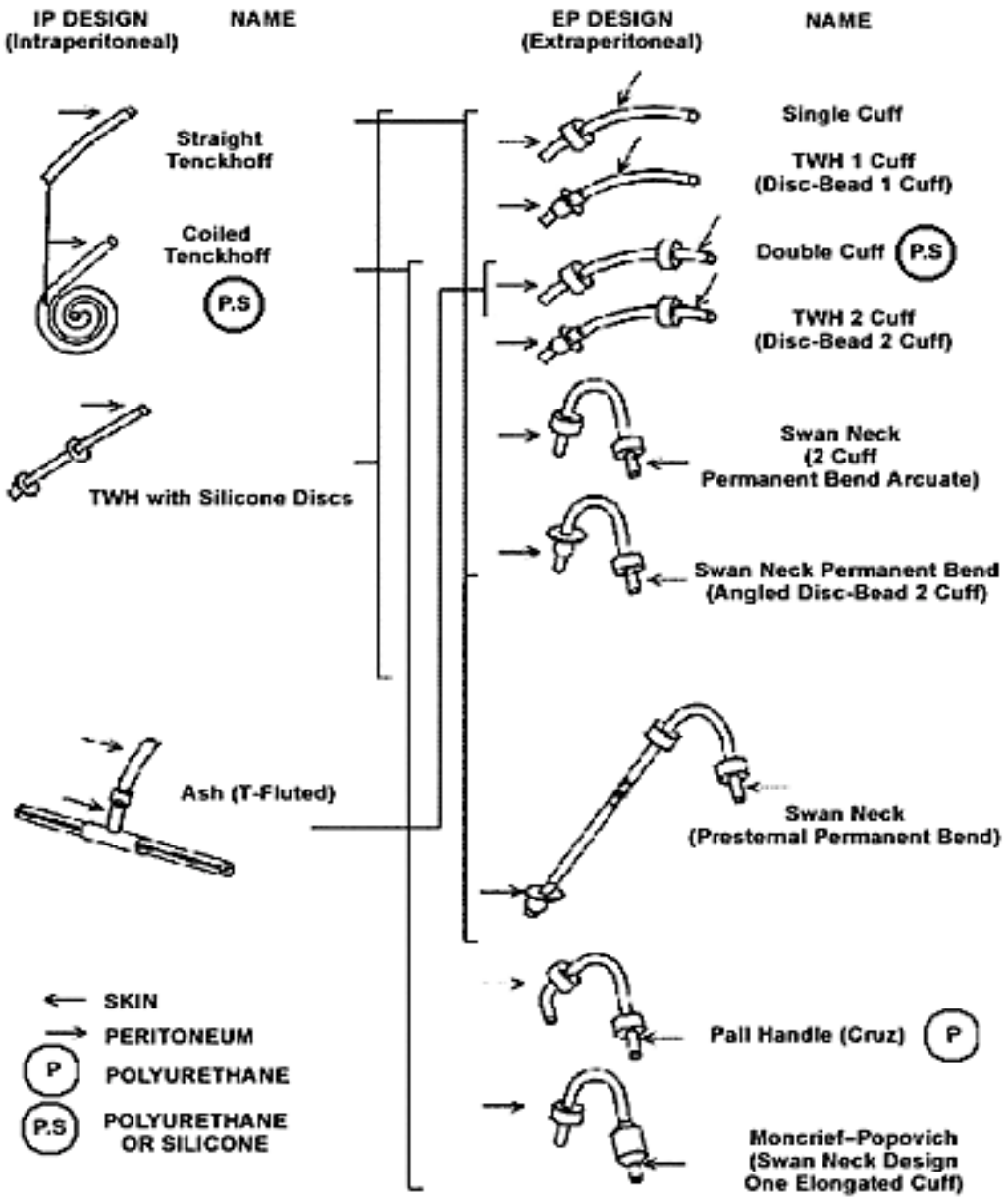
- **Why place a catheter? AND if you do**
- **What kind of catheter - cuffed or uncuffed?**
  - acute or chronic renal failure
  - ?bacteremic
  - you want to start dialysis when????
  - for LRD transplant soon
  - waiting to start PD or get over peritonitis
  - peripheral vascular disease
  - no more surgical access sites
  - no more surgeries thankyou!

Hemodialysis access catheters



CURRENTLY AVAILABLE CHRONIC PERITONAEAL CATHETERS

COMBINATIONS OF IP AND EP DESIGNS



Hemodialysis associated infections

Am J Inf Control 30/5 2002

- **Infection rate100 pt/month**

Native (AV) fistula	**0.56**
AV graft	**1.36**
Cuffed catheter	**8.42**
Non cuffed catheter	**11.98**
Overall	**3.2**

Indications for vascular access removal

- Proven infection of graft or shunt
- Repeated positive blood cultures
- Exit site or tunnel infection unresponsive to treatment

Indications for PD catheter removal (absolute)

Abdominal perforation*

Fungal peritonitis *

Tb peritonitis*

Exitsite infection

Pseudomonas

S. aureus with tunnel infection

*** may attempt to treat initially**

Indications for PD catheter removal (absolute)

Abdominal perforation*

Fungal peritonitis *

Tb peritonitis*

Exitsite infection

Pseudomonas

S. aureus with tunnel infection

*** may attempt to treat initially**

Indications for PD catheter removal (elective)

Repeated peritonitis with same organism

Frequent peritonitis relapse

Peritonitis unresponsive to treatment

Disfunctional catheter

(copious proud flesh, extruded cuff, obstruction, etc.)

PD catheter replacement

Same day

All elective replacements

Peritonitis (treated, cell count < 100)

Exit site infection (under antibiotic coverage)

2-3 weeks wait

Unresponsive peritonitis

4-6 weeks wait

Tb or fungal peritonitis

Antibiotic Lock Therapy

- **Which antibiotic?**
  - vancomycin, cefazolin, ceftazidime, & gentamycin
- **How much?**
  - 10mg/ml 1,2,3 & 5mg/ml for gentamycin
- **With heparin 5000 u/s per ml**
- **all 4 stable in vitro - some adsorbency in CVCs**
- **Need clinical study in vivo**

(Vercaigne et al, Pharmacotherapy, 7/2000)

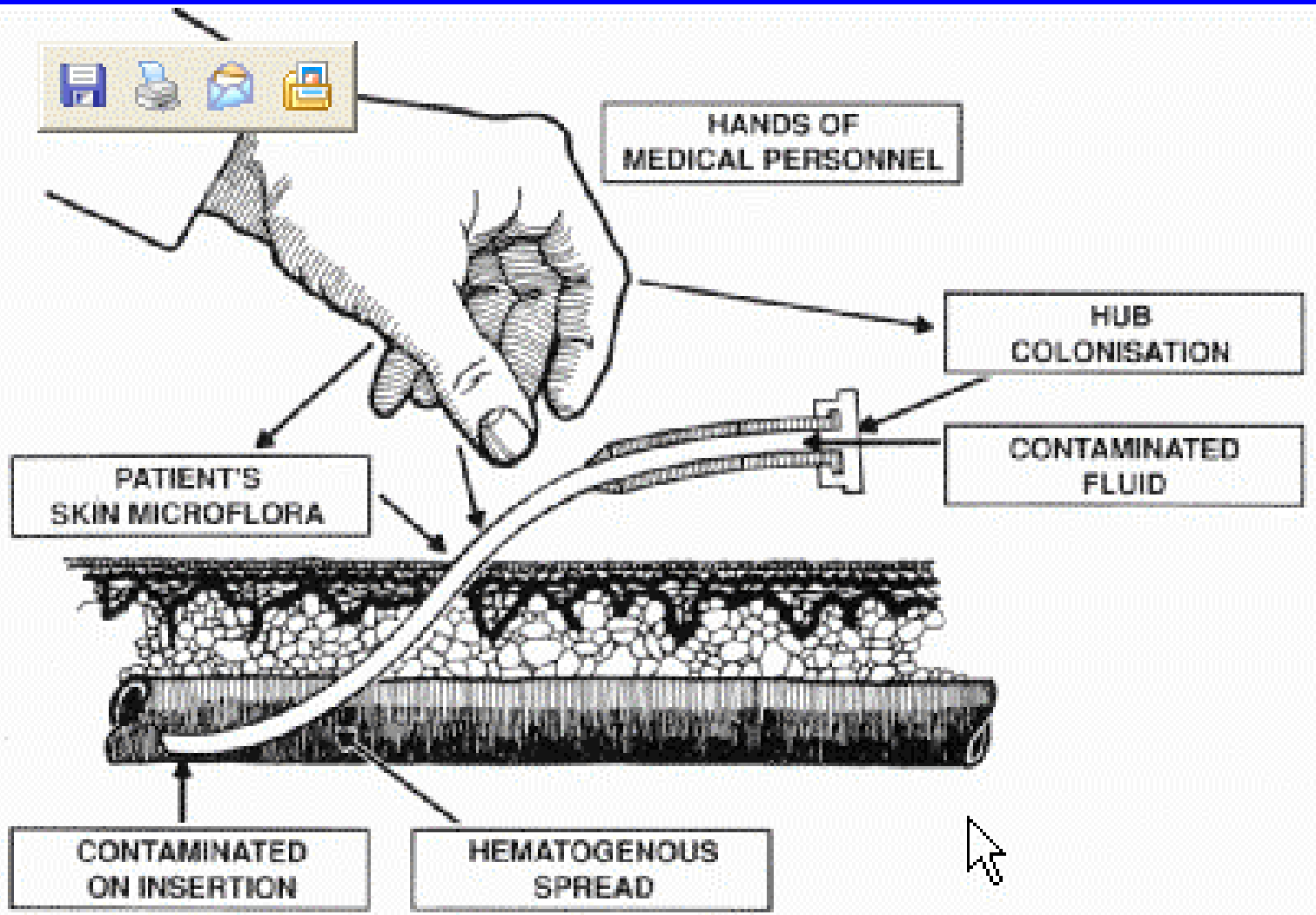


Fig. 1. Potential sources for contamination of intravascular devices.

External Catheter Care

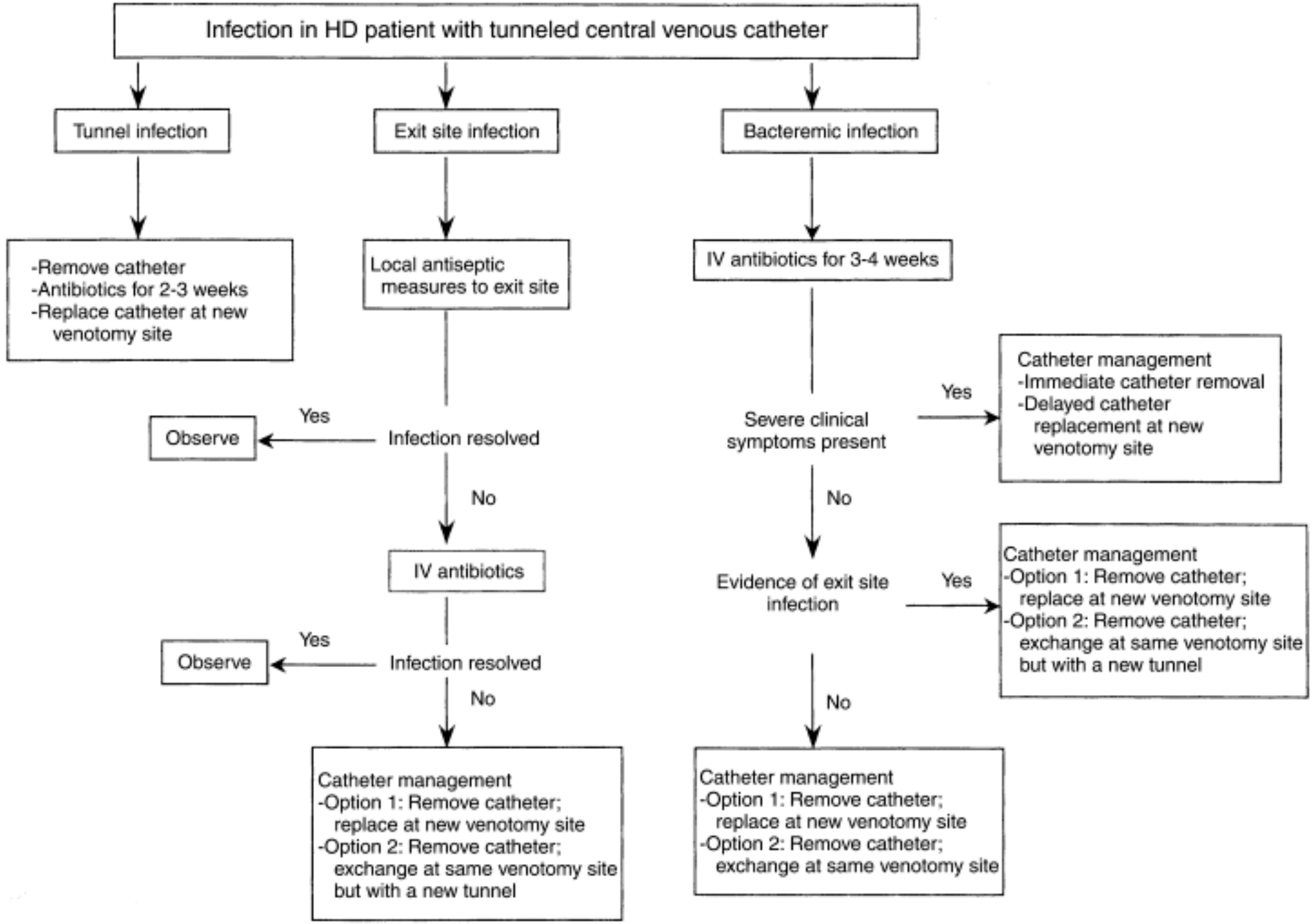
- Is there a universal bactericide for catheter port soaking and exit site cleaning?
- Exit site - to dress or not to dress? And with what? And how often?
- Can the patient shower or swim?
- Securing the catheter for safety
- Catheter repairing

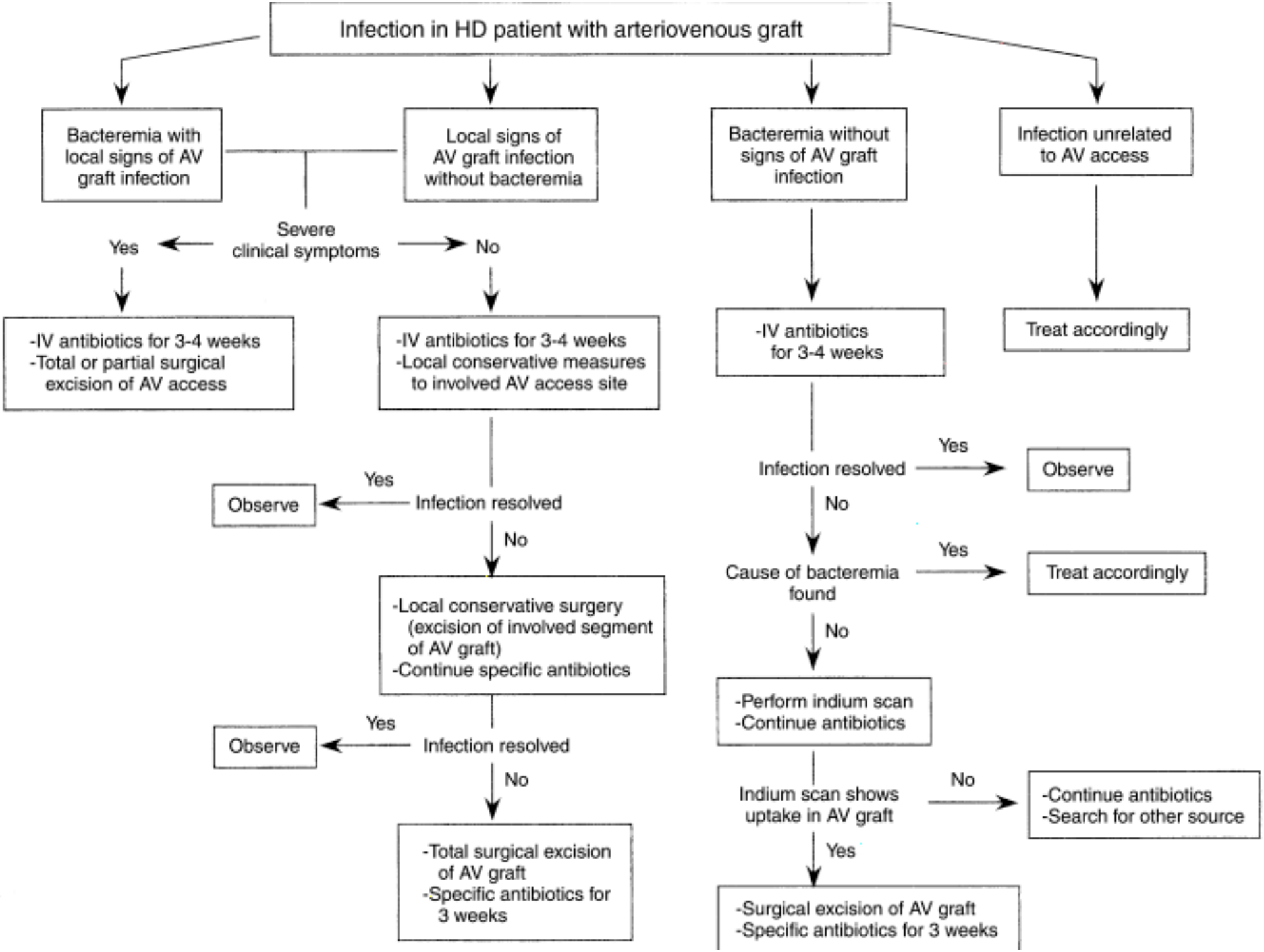
Use the Proper Precautions!

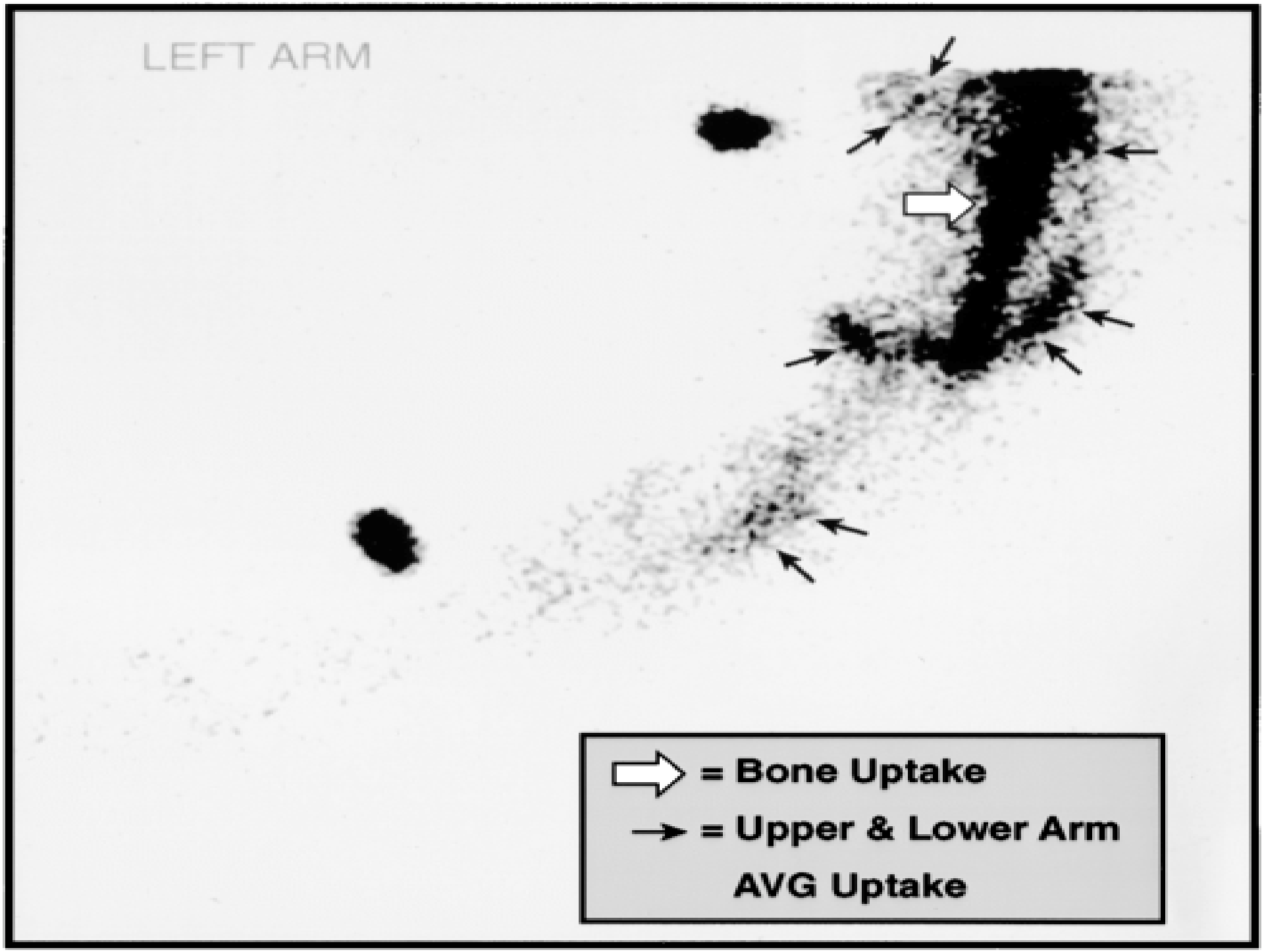
- Face masks for you and the patient
- Gloves
- Aprons
- Aseptic technique

Catheters in the Future

- Antibiotic locking therapy standard
- Antimicrobial locking solutions such as taurolidine prophylactically (Neutrolin by Biolink)
- Subcutaneous catheter ports
  - Dialock by Biolink
  - Lifesite by Vasca
- FDA approved and reimbursed lytic therapy
- cohesive collaborative care to increase catheter safety and effectiveness


Infection in HD patient with tunneled central venous catheter
Tunnel infection
Exit site infection
Bacteremic infection
-Remove catheter
-Antibiotics for 2-3 weeks
-Replace catheter at new venotomy site
Local antiseptic measures to exit site
IV antibiotics for 3-4 weeks
Yes
Observe
Infection resolved
No
IV antibiotics
Yes
Observe
Infection resolved
No
Catheter management
-Option 1: Remove catheter; replace at new venotomy site
-Option 2: Remove catheter; exchange at same venotomy site but with a new tunnel
Severe clinical symptoms present
Yes
Catheter management
-Immediate catheter removal
-Delayed catheter replacement at new venotomy site
No
Evidence of exit site infection
Yes
Catheter management
-Option 1: Remove catheter; replace at new venotomy site
-Option 2: Remove catheter; exchange at same venotomy site but with a new tunnel
No
Catheter management
-Option 1: Remove catheter; replace at new venotomy site
-Option 2: Remove catheter; exchange at same venotomy site


Infection in HD patient with arteriovenous graft
Bacteremia with local signs of AV graft infection
Local signs of AV graft infection without bacteremia
Bacteremia without signs of AV graft infection
Infection unrelated to AV access
Severe clinical symptoms
Yes
No
-IV antibiotics for 3-4 weeks
-Total or partial surgical excision of AV access
-IV antibiotics for 3-4 weeks
-Local conservative measures to involved AV access site
-IV antibiotics for 3-4 weeks
Treat accordingly
Infection resolved
Yes
Observe
No
-Local conservative surgery (excision of involved segment of AV graft)
-Continue specific antibiotics
Infection resolved
Yes
Observe
No
-Total surgical excision of AV graft
-Specific antibiotics for 3 weeks
Infection resolved
Yes
Observe
No
Cause of bacteremia found
Yes
Treat accordingly
No
-Perform indium scan
-Continue antibiotics
Indium scan shows uptake in AV graft
No
-Continue antibiotics
-Search for other source
Yes
-Surgical excision of AV graft
-Specific antibiotics for 3 weeks


LEFT ARM
= Bone Uptake
= Upper & Lower Arm
AVG Uptake

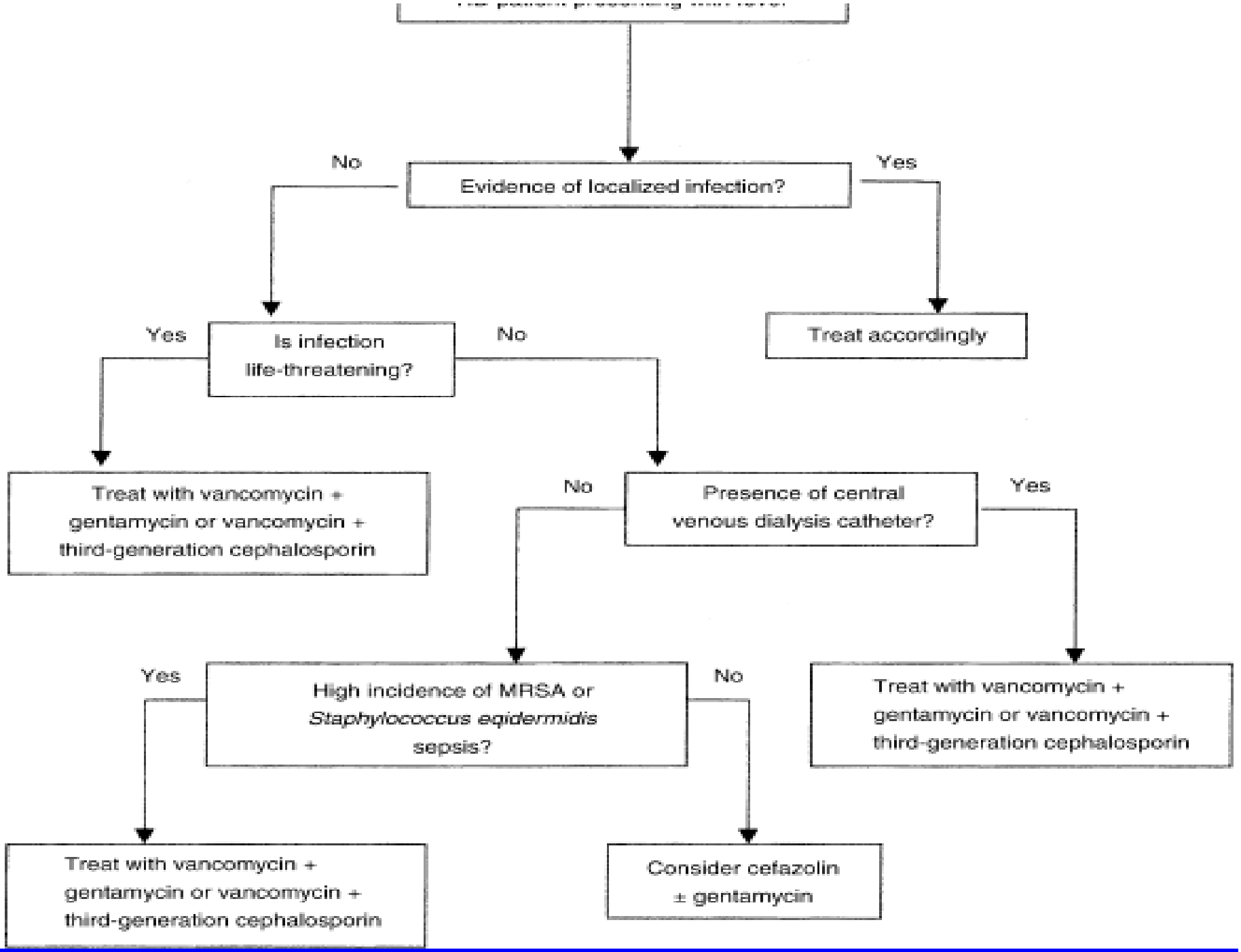

Evidence of localized infection?
No
Yes
Treat accordingly
Is infection life-threatening?
Yes
No
Treat with vancomycin + gentamycin or vancomycin + third-generation cephalosporin
Presence of central venous dialysis catheter?
No
Yes
High incidence of MRSA or *Staphylococcus epidermidis* sepsis?
Yes
No
Treat with vancomycin + gentamycin or vancomycin + third-generation cephalosporin
Treat with vancomycin + gentamycin or vancomycin + third-generation cephalosporin
Consider cefazolin ± gentamycin

Table 1. Incidence of bacteremia in hemodialysis patients

Source [reference]	Country	Year	*N*	Incidence of bacteremia per 100 patient-years	Bacteremia due to vascular access	% bacteremia due to gram-positive cocci
Dobkin et al. [13]	USA	1978	N/A	15	73%	70% [a]
Kessler et al. [8]	France	1993	1455	8.4	51%	69.80%
USRDS [1]	USA	1996	USRDS	7.6	48%	N/A
Marr et al. [9][b]	USA	1998	445	14.4	89%	100%
Kaplowitz et al. [18]	USA	1988	71	8.4	27%	50% [c]
Hoen et al. [20]	France	1998	988	11.2	N/A	68%

N denotes number of hemodialysis patients during the study period. N/A denotes data not available.

[a]Rate applies if bacteremia is vascular access-related

[b]A study on *staphylococcal aureus* bacteremia

[c]Percent of combined bacteremic and nonbacteremic infections related to vascular access

Nassar, George M. & Ayus, Juan Carlos
Infectious complications of the hemodialysis access.
Kidney International **60** (1), 1-13.
Available from:
http://dx.doi.org/10.1046/j.1523-1755.2001.00765.x

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Table 2. Incidence of catheter-related bacteremia (CRB) in hemodialysis patients

Source [reference]	Country	Year	*N*	Incidence of CRB per 1000 catheter-days	% CRB due to gram-positive cocci
Moss et al. [28]	USA	1990	131	0.7	N/A
Marr et al. [29]	USA	1997	102	3.9	63%
Kairaitis and Gottlieb [21]	Australia	1999	105	6.5	100%
Beathard [30]	USA	1999	387	3.4	84.5% [b]
Saad [31]	USA	1999	101	5.5	67.4% [c]
Cuevas et al (abstract)[a]	Spain	1999	189	1.54	84%
Cuevas et al (abstract)	Spain	1999	45	1	84%

N denotes number of patients with hemodialysis catheters; N/A denotes data not available.

[a] A study on temporary dialysis catheters

[b] Includes 9.8% of cultures due to mixed gram-positive and gram-negative infections

[c] Includes 12.8% cultures with mixed gram-positive and gram-negative infections

Nassar, George M. & Ayus, Juan Carlos
Infectious complications of the hemodialysis access.

Table 3. Risk factors for arteriovenous graft infection

Diabetes mellitus
Immuno-incompetency
Renal transplantation
Indwelling central venous catheter
History of bacteremia
Previous major infection in any organ system
Previous arteriovenous graft-related infection
Previous arteriovenous graft-related surgery
Fever of unknown origin

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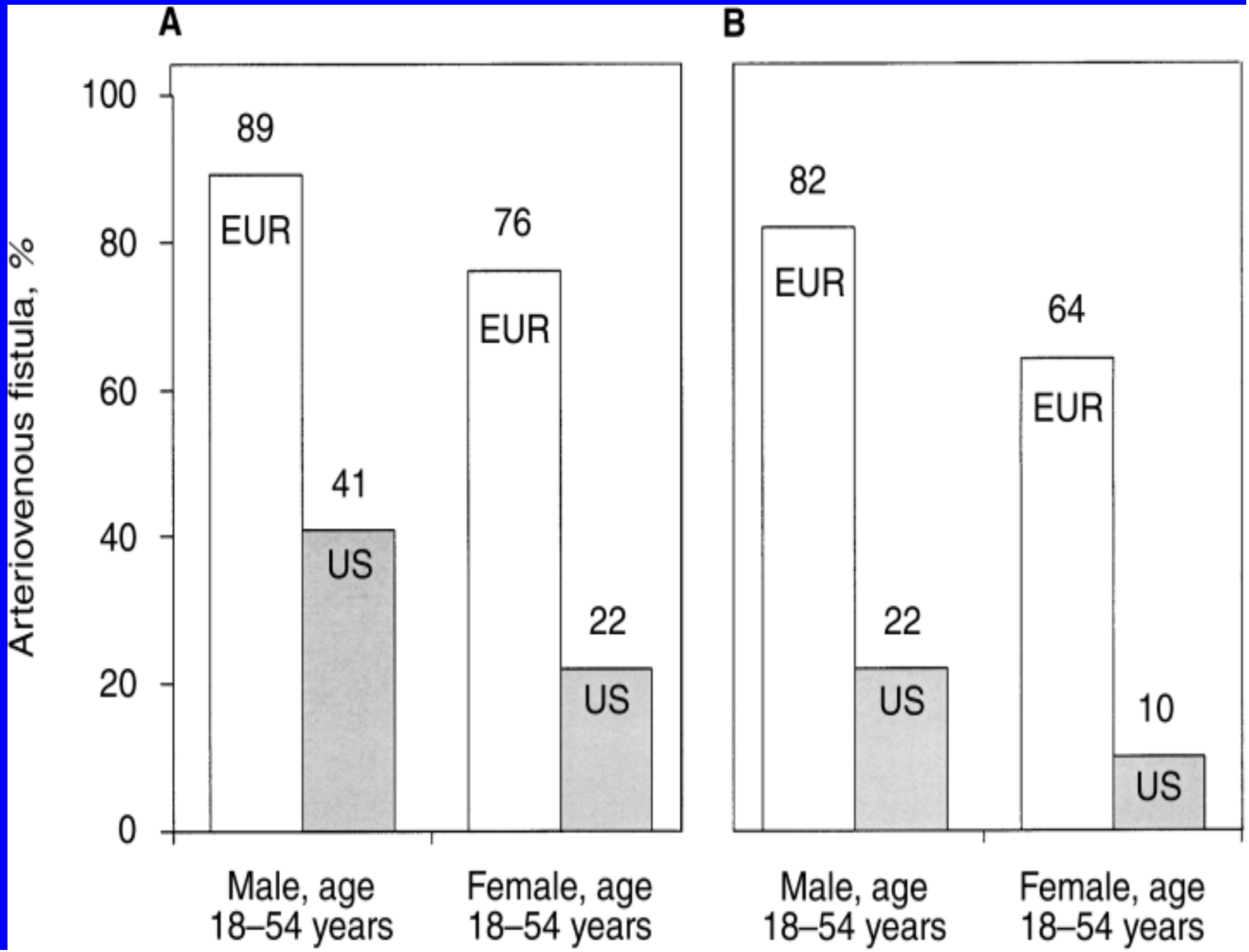
A
B
Arteriovenous fistula, %
100
80
60
40
20
0
89
EUR
41
US
76
EUR
22
US
82
EUR
22
US
64
EUR
10
US
Male, age 18–54 years
Female, age 18–54 years
Male, age 18–54 years
Female, age 18–54 years