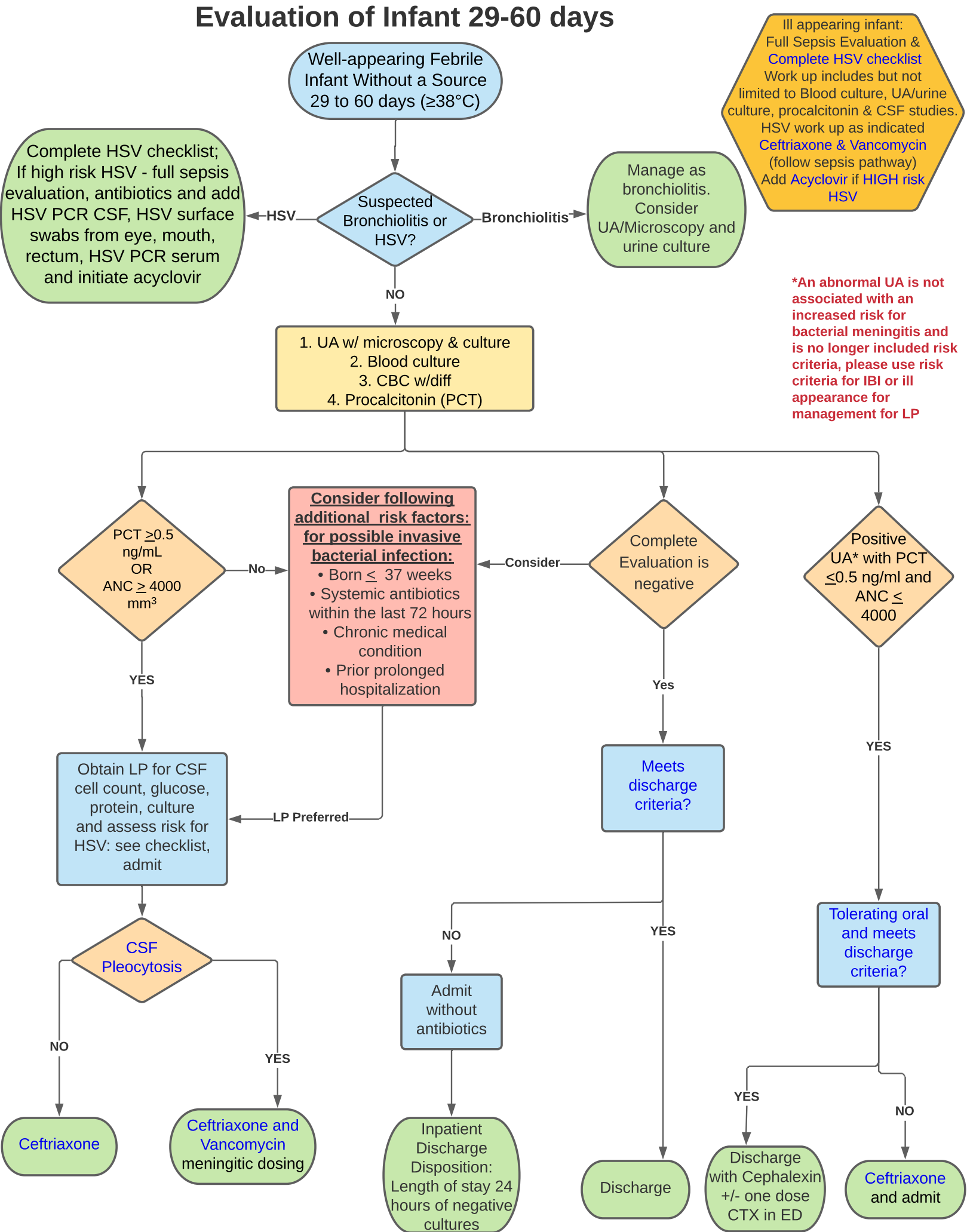


Evaluation of Infant 29-60 days



CSF Pleocytosis Reference Ranges

Inability to obtain CSF in ED

- Administer antibiotics within 60 minutes, should not be held for severely ill patients pending LP
- Rapid CSF Bacterial PCR can be sent on pre-treated CSF that demonstrates pleocytosis

CSF Pleocytosis can vary by age, listed values below should be used in conjunction with clinical judgement and patient characteristics

- ≤ 28 days: 15 cells/mm³
- 29-60 days: 9 cells/mm³

Additional reference ranges for healthy newborns

Table 6-12 Hematologic and Chemical Characteristics of Cerebrospinal Fluid in Healthy Newborns: Results of Selected Studies						
Study (year)	No. of Patients	Age (days)	White Blood Cells* (mm ³)	Neutrophils* (mm ³)	Glucose* (mg/dL)	Protein* (mg/dL)
Naidoo ⁸¹³ (1968)	135	1	12 (0-42)	7 (0-26)	48 (38-64)	73 (40-148)
	20	7	3 (0-9)	2 (0-5)	55 (48-62)	47 (27-65)
Sarff ⁴⁸⁸ (1976)	87	Most < 7	8.2 ± 7.1, median 5 (0-32)	61	52 (34-119)	90 (20-170)
Bonadio ⁵⁶⁵ (1992)	35	0-4 wk	11.0 ± 10.4, median 8.5	0.4 ± 1.4, median 0.15	46 ± 10.3	84 ± 45.1
	40	4-8 wk	7.1 ± 9.2, median 4.5	0.2 ± 0.4, median 0	46 ± 10.0	59 ± 25.3
Ahmed ⁵⁶⁶ (1996)	108	0-30	7.3 ± 13.9, median 4	0.8 ± 6.2, median 0	51.2 ± 12.9	64.2 ± 24.2

Data from Ahmed A, Hickey S, Ehrett S, et al: Cerebrospinal fluid values in the term neonate, *Pediatr Infect Dis J* 15:298, 1996.

*Expressed as mean with range (number in parentheses) or ± standard deviation unless otherwise specified.

Nizet, V. and Klein, J. ed., 2016. Bacterial Sepsis and Meningitis. In: *Remington and Klein's Infectious Diseases of the Fetus and Newborn Infant*, 8th ed.

TABLE 2 CSF Values in Febrile Infants Without Evidence of UTI, IBI, HSV, Enterovirus, or Traumatic CSF

	Age, d	n	Mean	Median	Range
WBCs per mm ³	1–28	278	6.1	5.0	0–18
	29–60	318	3.1	3.0	0–8.5
Protein mg/dL	1–28	278	75.4	73.0	15.8–131.0
	29–60	318	58.9	54.0	5.5–105.5
Glucose	1–28	278	45.3	46.0	30.0–61.0
	29–60	318	48.0	48.0	20.6–65.5
RBCs per mm ³	1–28	278	95.5	5.5	0–236
RBCs per mm ³	29–60	318	75.5	2.0	0–64.5

Statistical outliers were removed. Other studies reveal slightly different ranges. Local laboratory tests may provide slightly different upper limits of normal. Adapted from Byington CL, Kendrick J, Sheng X. Normative cerebrospinal fluid profiles in febrile infants. *J Pediatr*. 2011;158(1):130–134.

HSV should be considered when there is:

- Maternal history of genital HSV lesions or fever from 48 hours before to 48 hours after delivery
- Infants with vesicles, seizures, hypothermia, mucous membrane ulcers
- CSF pleocytosis in the absence of a positive Gram stain result
- Consider in the presence of leukopenia, thrombocytopenia, or elevated alanine aminotransferase levels.

Return to Pathway

Neonatal Drug Guidelines UCSF Benioff Children's Hospital 2019 – 2021

Drug		Dose	Interval	Mode
Antibacterials/Antifungals/Antivirals:				
Acyclovir		20 mg/kg/dose	q 8 hours	IV
Amphotericin	Conventional (Fungizone®)	1 mg/kg/dose	q 24 hours	IV
	Liposomal (Ambisome®)	5 mg/kg/dose	q 24 hours	IV
Ampicillin	Meningitis	100 mg/kg/dose	see Interval A	IV
	Non-meningitis	50 mg/kg/dose	see Interval A	IV
Azithromycin	(pertussis)	10 mg/kg/dose	q 24 hours x 5 days	IV/PO
Cefazolin		25 mg/kg/dose	see Interval B	IV
Cefepime		50 mg/kg/dose	q 12 hours	IV
	Meningitis		q 8 hours	IV
Cefotaxime		50 mg/kg/dose	see Interval A	IV
	Meningitis		see Interval C	IV
Ceftriaxone	<i>May be considered in neonates ≥ 41 weeks corrected GA and > 14 days PNA without hyperbilirubinemia or any anticipated calcium containing IV solutions within 48 hours of ceftriaxone therapy. Consult pharmacist for verification of criteria and dosing guidance.</i>			
Ceftazidime		50 mg/kg/dose	see Interval B	IV
Clindamycin		see Column E	q 8 hours	IV
Fluconazole	Treatment	LOAD 25 mg/kg x1, then 12 mg/kg/dose	q 24 hours	IV/PO
	Prophylaxis	6 mg/kg/dose: ≤ 29 wks corr. GA & ≤ 28 d PNA: q 72 hours > 29 wks corr. GA or > 28 d PNA: q 48 hours		IV/PO
Gentamicin and Tobramycin		see chart at bottom for dosing and interval		IV
Meropenem	20 mg/kg/dose	(40 mg/kg/dose for meningitis/pseudomonas) < 32 weeks GA & < 14 days PNA > 32 weeks GA or ≥ 14 days PNA	q 12 hours q 8 hours	IV IV
Metronidazole		≤ 33 weeks corr. GA: 7.5 mg/kg/dose LOAD 15 mg/kg x1, 34-40 weeks corr. GA: 7.5 mg/kg/dose followed 8-12 hours later by: ≥ 41 weeks corr. GA: 10 mg/kg/dose	q 12 hours q 8 hours q 8 hours	IV IV
Nafcillin		50 mg/kg/dose	see Interval A	IV
PenicillinG (aq)	congenital syphilis:	50,000 units/kg/dose x 10 days	see Interval A	IV
Piperacillin/tazobactam	Sepsis:	80 mg piperacillin/kg/dose	see Interval C	IV
	Pseudomonas:	100 mg piperacillin/kg/dose		
TMP/SMX (Bactrim/Septra)	<i>Generally avoided ≤44 weeks corrected Gestational Age</i>			
Vancomycin		≤ 29 wks corr. GA: 10 mg/kg/dose > 29 wks corr. GA: 15 mg/kg/dose	q 12 hours see Interval D	IV IV

Corrected Gestational age (weeks)	Postnatal age (days)	Interval A	Interval B	Interval C	Interval D	Column E
≤ 29	0 – 28	q 12°	q 12°	q 12°	see drug entry	4 mg/kg/dose
	> 28	q 8°	q 8°	q 8°		
30 – 36	0 – 14	q 12°	q 12°	q 8°	q 12°	6 mg/kg/dose
	> 14	q 8°	q 8°	q 6°	q 8°	
37 – 44	0 – 7	q 12°	q 12°	q 8°	q 12°	8 mg/kg/dose
	> 7	q 8°	q 8°	q 6°	q 8°	
≥ 45	All	q 6°	q 8°	q 6°	q 6°	10 mg/kg/dose

Chart below is for dosing of Gentamicin & Tobramycin ONLY

BIRTH to 1 MONTH

Gestational Age (weeks)	Dose	Interval
≤ 28	3.5 mg/kg/dose	q 36 hours
29 – 34	3.5 mg/kg/dose	q 24 hours
≥ 35	5 mg/kg/dose	q 24 hours (q36h for HIE or significant asphyxia)

< 35 week GA: Order Peak/Trough with 4th dose
≥ 35 week GA: Order Trough ONLY with 4th dose
(for HIE or significant asphyxia, P/T with 3rd dose)

> 1 MONTH POSTNATAL

Corrected Gestational Age (weeks)	Dose	Interval
< 35	2.5 mg/kg/dose	q 12 hours
≥ 35		q 8 hours^

^Renal or cardiac dysfunction, use 2.5 mg/kg/dose IV q12 to 24 hours

Discharge Checklist

- Are the parents comfortable with monitoring the child at home
- Do parents have reliable means of receiving communication from hospital
- Can culture results be followed daily by hospital staff
- Can patient follow up with PCP within 24 hours
- Can patient tolerate oral antibiotics, if indicated

If NO to ANY: Admit

Return to pathway

Validity of using the UA as a screening tool before sending a urine culture

1. Schroeder AR, Chang PW, Shen MW, Biondi EA, Greenhow TL. Diagnostic accuracy of the urinalysis for urinary tract infection in infants <3 months of age.*Pediatrics*. 2015;135(6):965-971
2. Tzimenatos L, Mahajan P, Dayan PS, et al. Accuracy of the urinalysis for urinary tract infections in febrile infants 60 days and younger.*Pediatrics*. 2018;141(2):e20173068

Use of inflammatory markers for risk stratification

1. Aronson PL, Shabanova V, Shapiro ED, et al. A prediction model to identify febrile infants ≤60 days at low risk of invasive bacterial infection.*Pediatrics*. 2019;144(1):e20183604
2. Gomez B, Mintegi S, Bressan S, et al. Validation of the "Step-by-Step" approach in the management of young febrile infants.*Pediatrics*. 2016;138(2):e20154381. doi: 10.1542/peds.2015-4381. Epub 2016 Jul 5
3. Kuppermann N, Dayan PS, Levine DA, et al. A clinical prediction rule to identify febrile infants 60 days and younger at low risk for serious bacterial infections.*JAMA Pediatr*. 2019;173(4):342-35160
4. Milcent K, Faesch S, Gras-Le Guen C, et al. Use of procalcitonin assays to predict serious bacterial infection in young febrile infants.*JAMA Pediatr*. 2016;170(1):62-69

Use of selective lumbar punctures in febrile infants with positive UAs

1. Burstein B, Sabhaney V, Bone JN, Doan Q, Mansouri FF, Meckler GD. Prevalence of bacterial meningitis among febrile infants aged 29-60 days with positive urinalysis results: a systematic review and meta-analysis.*JAMA Netw Open*. 2021 May 3;4(5):e214544
2. Velasco R, Lejarzegi A, Gomez B, et al. Febrile young infants with abnormal urine dipstick at low risk of invasive bacterial infection.*Arch Dis Child*. 2020 Nov 27:archdischild-2020-320468
3. Wang ME, Biondi EA, McCulloh RJ, et al. Testing for meningitis in febrile well-appearing young infants with a positive urinalysis.*Pediatrics*. 2019;144(3):e20183979
4. Young BR, Nguyen THP, Alabaster A, Greenhow TL. The prevalence of bacterial meningitis in febrile infants 29-60 days with positive urinalysis.*Hosp Pediatr*. 2018;8(8):450-457
5. Use of Oral Antibiotics in Febrile Infants 29-60 days with positive UAs
6. Hoberman A, Wald ER, Hickey RW, et al. Oral versus initial intravenous therapy for urinary tract infections in young febrile children.*Pediatrics*. 1999;104(1 Pt 1):79-86

CSF Values

1. Thomson J, Sucharew H, Cruz AT, et al. Cerebrospinal Fluid Reference Values for Young Infants Undergoing Lumbar Puncture.*Pediatrics*. 2018;141(3). doi:[10.1542/peds.2017-3405](https://doi.org/10.1542/peds.2017-3405)

Disposition**Discharge from the hospital within 24-36 hours:**

1. Aronson PL, Wang ME, Nigrovic LE, et al. Time to pathogen detection for non-ill versus ill-appearing infants ≤60 days old with bacteremia and meningitis.*Hosp Pediatr*. 2018;8(7):379-384
2. Biondi EA, Mischler M, Jerardi KE, et al. Blood culture time to positivity in febrile infants with bacteremia.*JAMA Pediatr*. 2014;168(9):844-849

Discharge from the emergency department with close follow-up:

1. Alpern ER, Kuppermann N, Blumberg S et al. Time to positive blood and cerebrospinal fluid cultures in febrile infants ≤60 days of age.*Hosp Pediatr*. 2020 Sep;10(9):719-727
2. Greenhow TL, Hung YY, Pantell RH. Management and outcomes of previously healthy, full-term, febrile infants ages 7 to 90 days.*Pediatrics*. 2016;138(6):e20160270
3. Mintegi S, Gomez B, Martinez-Virumbrales L, Morientes O, Benito J. Outpatient management of selected young febrile infants without antibiotics.*Arch Dis Child*. 2017 Mar;102(3):244-249
4. Pantell RH, Newman TB, Bernzweig J, et al. Management and outcomes of care of fever in early infancy.*JAMA*. 2004;291(10):1203-1212

Parent Engagement

1. Aronson PL, Politi MC, Schaeffer P, et al. Development of an app to facilitate communication and shared decision-making with parents of febrile infants ≤60 days old.*Acad Emerg Med*. 2021;28(1):46-59