

Fever in Children Younger Than Three Months of Age

A Pooled Analysis

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Concern that febrile infants younger than 3 months of age are at high risk of serious infection has prompted a management policy of routine hospitalization with antibiotic administration. Ten published studies of febrile infants younger than 3 months of age were reviewed, and data were statistically combined to develop estimates of the risk of bacteremia and serious infection. Factors that predicted increased risk were similarly evaluated. Mean and median risk estimates included, respectively, 3.0 and 3.4 percent for bacteremia, 1.3 and 1.0 percent for septic meningitis, and 5.0 and 7.0 percent for pneumonia. These were no higher than comparable estimates for older infants. Clinical appearance was 92 percent sensitive in predicting bacteremia in 500 infants (23 of 25 cases). Younger age, higher fever, and elevated white blood cell count were associated with increased risk of serious infection.

Data from these studies do not support the belief that febrile infants younger than 3 months are uniformly at greater risk of serious infection than older infants. Judicious evaluation of younger infants could lead to more selective, cost-efficient management.

The management of febrile infants younger than 3 months of age is problematic. It is held that these infants localize infections poorly and thus are at greater risk than older children for serious, disseminated infections such as meningitis and septicemia.¹⁻³ Rates of bacteremia are reported as between 4 and 15 percent,¹ and the risk of serious infection has been calculated to be more than 20 times as great as for older infants.³ Young infants are also thought to present fewer diagnostic clues to alert the clinician to serious illness.^{1,4} Many physicians routinely hospitalize infants younger than 3 months of age and treat them with parenteral antibiotics while awaiting results of diagnostic cultures.⁵⁻⁷ While this approach may be justified because of the infants' risk status, there are adverse physical and economic consequences of such a policy.⁷

This article combines data from published studies that report the rate of serious illness in febrile children younger than 3 months of age to provide more accurate risk estimates on which to base management strategies. Specific questions addressed include the following:

1. Is the incidence of serious infection higher for infants younger than 3 months of age compared with older children?
2. How likely is the febrile infant who has no focal signs of infection to have bacteremia?
3. What diagnostic strategies are useful in identifying young infants at risk of serious infections?

METHODS

Articles reporting evaluations of febrile infants 3 months of age or younger were identified through computer searches of the medical literature for the past 15 years and by reviewing bibliographies of published studies. Studies were selected only if they were written in English

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TABLE 1. FEATURES OF TEN SELECTED STUDIES OF INFANTS YOUNGER THAN 3 MONTHS OF AGE WITH FEVER

Study Reference/Year	Design	Criteria: Months of Age Temperature (°C)	Sample Size	Site/Percent Admitted Percent of Visits
A. McCarthy PL, Dolan TE, 1976 ⁴	Chart review	3 37.8	149	Yale-New Haven Hospital Emergency room patients
B. Roberts KB, Borzy MS, 1977 ⁵	Prospective	2 38	61	Johns Hopkins Hospital Outpatients—98% admitted and treated
C. O'Shea, 1978 ⁸	Prospective	3 38	33	Rhode Island Hospital Outpatients—0.1% of visits
D. Greene JW et al, 1981 ⁶	Chart review/ prospective	2 37.8	147	Metropolitan Nashville General Outpatients—86% admitted
E. Crain EF, Shelov SP, 1982 ⁹	Prospective	2 38	175	Bronx Municipal Hospital Emergency room patients— 100% admitted, 0.1% of visits
F. Caspe WB et al, 1983 ¹⁰	Prospective	2 38	305	Bronx-Lebanon Hospital Outpatients—100% admitted, 0.1% of visits
G. DeAngelis C et al, 1983 ⁷	Chart review	2 38	190	Johns Hopkins Hospital Outpatients—100% admitted
H. Klein JO et al, 1984 ¹¹	Chart review	3 37.8	187	Boston City Hospital Walk-in clinic patients—48% admitted, 0.7% of visits
I. Dagan R et al, 1985 ¹²	Prospective	3 Unspecified "?? sepsis"	233	Strong Memorial Hospital, Rochester—Inpatients
J. Krober MS et al, 1985 ¹³	Prospective	3 38	182	Tripler Army Medical Center Honolulu Outpatients—100% admitted

and reported diagnostic information on a series of 20 infants or more who were discharged from full-term nurseries and brought to ambulatory facilities for evaluation of fever. Prospective studies and chart reviews were acceptable; descriptions of each study's subject inclusion criteria, diagnostic testing, and clinical outcomes were required. Studies were not reviewed if information on infants younger than 3 months of age could not be identified or if infants with specific illnesses, such as exanthems or meningitis, were excluded.

Data were combined in two ways. Mean risk estimates for such diagnoses as meningitis or bacteremia were calculated by dividing the number of cases in all studies by the total number of patients at risk. These denominators vary, since not every study provided information on all diagnoses. Because the number of subjects across studies varied, and mean estimates could be influenced by study sample sizes, median incidence rates were also calculated. The estimated rate for each diagnosis such as bacteremia was ranked as an independent observation, and a median value and range were determined.

Each study was also reviewed to determine which commonly performed tests were useful in predicting risk of

"serious infection." Although criteria for "serious infection" differed, all studies included bacteremia (a pathogenic bacterium in a blood culture) as a minimum, and variously included meningitis, pneumonia, gastroenteritis, urinary tract infection, and osteomyelitis and septic arthritis.

RESULTS

Ten studies dating from 1976 through 1985 met criteria for inclusion in the review.⁴⁻¹³ Five of the studies were carried out on patients aged 2 months or younger and five on infants aged 3 months or younger. Six studies were prospective in design, three were done by chart review, and one represented a combination of the two methodologies. Sample sizes ranged from 33 to 305 patients, with a total of 1,662 patients represented in the ten studies. East Coast teaching center hospitals dominated the study sites (Table 1).

Definitions of fever were reasonably consistent: three studies admitted children with rectal temperatures of 37.8

°C or higher, six used 38 °C as the admission criterion, and one used the entry criterion of "possible sepsis."

Infants in all ten studies received physical examinations, and in three, house officers were asked to give an overall clinical impression as to whether the infant was "well," "ill," or "possibly septic." Results of blood cultures and examinations of the cerebral spinal fluid were reported from virtually all patients in seven of the studies, with selective use of the two procedures reported in two others, and no data in one study.

At the time the studies were conducted, the predominating management approach was to hospitalize the infants and treat with intravenous antibiotics pending results of the diagnostic cultures. Over 90 percent of infants were admitted to the hospital in eight of the studies; the percentage of admissions in two studies was unclear.

Diagnoses

The frequency of diagnoses for patients in the nine studies in which information was available is summarized in Table 2. The single most common diagnosis was fever without focus and/or upper respiratory tract infection, followed by aseptic meningitis, otitis media, gastroenteritis, and pneumonia. Bacterial meningitis occurred in 1.3 percent of infants. For most of the eight diagnostic classifications listed, estimated mean and median rates are similar, and the ranges are reasonably narrow.

Bacteremia

The rates of positive blood culture results among patients in nine studies were calculated and are presented in Table 3. Among a total of 1,472 patients there were 44 (3.0 percent) with positive results. The median rate of bacteremia for the nine studies was 3.4 percent, with a range of 0.0 to 14.8 percent. Twenty-one of the children had a specific focus identified: septic meningitis in nine, gastroenteritis in three, pyogenic arthritis or osteomyelitis in three, and skin or soft tissue infections in three. Bacteria were specified in 35 cases of bacteremia including group B streptococcus in 17, *Streptococcus pneumoniae* in five, *Salmonella* and *Escherichia coli* in four each, and *Hemophilus influenzae* in two.

Among the 704 patients with no focus of infection or with mild respiratory signs and symptoms only, a mean of 2.1 percent had bacteremia, with a median for the nine studies of 1.4 percent. The range of bacteremia rates was 0.0 to 10.5 percent. In seven of nine studies, however, rates of less than 5 percent were observed, and the two reports estimating 9 to 10 percent of infants had bacteremia contained the smallest samples (33 and 61 patients).

Comparison rates of serious illness, including septic

TABLE 2. DIAGNOSES OF FEBRILE CHILDREN YOUNGER THAN 3 MONTHS OF AGE, FROM NINE STUDIES

Diagnoses	Mean (%) (total cases)	Median (%)	Range (%)
Bacterial meningitis (N = 1,429)*	1.3	1	0-5
Aseptic meningitis (N = 1,396)	12.2	12	1-30
Otitis media (N = 1,396)	9.0	10	3-15
Pneumonia (N = 1,282)	5.4	7	1-8
Skin or soft tissue infection (N = 1,060)	2.5	2.5	1-10
Urinary tract infection (N = 1,209)	3.0	2	0-11
Gastroenteritis (N = 1,429)	6.8	5	2-17
No focus and/or URI only (N = 1,429)	49.3	39	33-67

* Number of patients evaluated
Note: Not all studies identified the number of cases with each diagnosis
URI—upper respiratory tract infection

meningitis, pneumonia, and bacteremia, were gathered from nine published studies of older febrile children.¹⁴⁻²² These studies were evaluated in the same manner as the index papers. Results are summarized in Table 4. The nine studies generally assessed children younger than 24 months of age, with five specifically excluding and four including very young infants. Level of fever required for entry into the studies ranged from 37.7 °C to 40 °C and was 38.9 °C or higher in five of the studies. Seven studies reported 254 episodes of bacteremia among a total of 4,389 febrile children for a mean of 5.8 percent. The median rate of bacteremia was 6.3 percent, with a range from 3.2 to 7.7 percent. In the five studies that identified 1,382 children for whom no focus of infection could be determined, there were 66 cases of bacteremia for an overall rate of 4.8 percent; the median rate was 4.4 percent, with a range from 2.9 to 6.6 percent. Forty-one cases of septic meningitis were reported among 3,415 subjects in five studies (1.2 percent); the median rate was 1.4 percent, with a range from 0.0 to 1.8 percent. The rates of bacteremia, septic meningitis, and pneumonia are compared in Table 5 for the nine studies of infants younger than 3 months of age and the nine studies that include older children. In none of these instances is the incidence of serious illness higher in the group of younger infants.

Predictors of Serious Infection

Six of the ten index studies systematically addressed the ability of one or more clinical or laboratory findings to

TABLE 3. BACTEREMIA IN FEBRILE CHILDREN YOUNGER THAN 3 MONTHS OF AGE, FROM TEN STUDIES

Study	Total No. of Patients	Percent Bacteremic	Patients With No Focus or URI Only	Percent Bacteremic
A	149	1.3	100	1.0
B	61	14.8	38	10.5
C	33	9.1	11	9.1
D	147	0.7	53	0.0
E	175	3.4	98	0.0
F	305	3.6	204	2.5
G	190	Unknown	74	1.4
H	187	1.6	64	4.7
I	233	3.9	Unknown	Unknown
J	182	0	62	0
Total patients	1,472*		704	
Mean (% total patients)		3.0		2.1
Median**		3.4		1.4
Range**		0-14.8		0-10.5

* Study G not included in total number of patients because of lack of data
 ** Percent of 9 studies

TABLE 4. DIAGNOSIS IN OLDER* FEBRILE CHILDREN, FROM NINE STUDIES

Diagnosis	Mean (%) (total cases)	Median (%)	Range (%)
Bacteremia			
All patients (N = 4,389)	5.8	6.3 (7 studies)	3.2-7.7
No focus of infection (N = 1,382)	4.8	4.4 (5 studies)	2.9-6.6
Septic meningitis (N = 3,415)	1.2	1.4 (5 studies)	0.0-1.8
Pneumonia (N = 2,472)	14.4	14.9 (4 studies)	5.3-16.9

* Up to 24 months old in five studies; older children included in four studies

TABLE 5. RATES OF SERIOUS INFECTIONS IN INFANTS YOUNGER THAN 3 MONTHS OF AGE (NINE STUDIES) COMPARED WITH OLDER CHILDREN (NINE STUDIES)

	Infants > 3 Months	Older Children
Bacteremia		
All patients (9 studies)	(9 studies)	(7 studies)
Mean	3.0	5.8
Median	3.4	6.3
No focus/URI (9 studies)	(9 studies)	(5 studies)
Mean	2.1	4.8
Median	1.4	4.4
Septic meningitis (9 studies)	(9 studies)	(5 studies)
Mean	1.3	1.2
Median	1.0	1.4
Pneumonia (8 studies)	(8 studies)	(4 studies)
Mean	5.4	14.4
Median	7.0	14.9

URI—upper respiratory tract infection

predict serious illness. In three studies serious illness was defined as bacteremia alone,^{5,9,10} and in three the definition included bacteremia as well as bacterial meningitis, pneumonia, gastroenteritis, urinary tract infection, bacterial infections of the bones and joints, and soft tissue infections.^{4,11,12} Predictive factors most often evaluated included age (the younger, the higher the risk), fever (the greater the fever, the higher the risk), white blood cell count (generally the higher the count, the more likely a serious illness), and physical appearance. This latter criterion was similarly defined in the three studies. Definitions included house officers' classification of infants into groups of "ill, questionably ill, and well,"⁵ house officers'

impression of sepsis as "strong, ambivalent, or negative,"⁹ and senior resident evaluation that infants were "ill or well."¹⁰ Features that house officers used in making assessments included activity, feeding, irritability, responsiveness, and consolability.

Significant associations between potential risk factors and serious illness were most often found for physical appearance (three of three studies),^{5,9,10} degree of fever (four of six studies),^{4,10,12} and high white cell count (three of five studies).^{10,12} One of four studies assessing age found a significant association between younger age and serious

TABLE 6. FEVER AND SERIOUS INFECTION IN INFANTS YOUNGER THAN 3 MONTHS OF AGE

Author	Fever Cutoff Point	Percent with Serious Infection		Sensitivity/ Specificity
		Fever Below Cutoff Point	Fever Equal to or Above Cutoff Point	
McCarthy and Dolan ⁴	40 °C	9.5	36.4	
Dagan et al ¹²	39 °C	6.7	14.6	61/61
Klein et al ¹¹	38.3 °C	4.1	32.0	81/72

illness,¹¹ with nonsignificant trends in the same direction in the three others.^{5,10,12} Three studies found that combinations of findings, usually high fever and elevated white cell count, were also significantly associated with serious illness.^{9,10,12} One study found that an elevated erythrocyte sedimentation rate predicted bacteremia both individually and in combination with clinical impression and white cell count.⁹

Physical Appearance

Three studies addressed the question of whether physical appearance identifies high-risk infants.^{5,9,10} Among the 500 febrile patients evaluated, 25 of the total of 44 episodes of bacteremia were represented. Twenty-three of the 25 cases of bacteremia were identified using the house officers' assessment that the infant appeared "ill," or gave a "strong" or "ambivalent" impression of illness. In other words, house officers' clinical evaluations were 92 percent sensitive in detecting bacteremia. At the same time 63 percent of the 475 "well" babies were correctly classified (specificity), and there were 175 infants suspected of serious illness who were not bacteremic. The posttest probability (predictive value) of bacteremia becomes 11.6 percent, twice the pretest probability.

Dagan et al¹² support the idea that high-risk infants can be recognized by clinical assessment. They classified 233 hospitalized infants younger than 3 months into "high-risk" groups according to physical examination, white cell count, differential, and urinalysis. Only one of 144 low-risk infants had serious bacterial illness (meningitis, cellulitis, osteomyelitis, or urinary tract infection) compared with 22 of 89 infants classed as high risk. None of the low-risk infants was bacteremic. Greene et al⁶ note that the incidence of serious bacterial infections was low among their 183 patients and that the three who "clearly had such an infection were recognized upon admission."

Age

Only four studies specifically evaluated age as a risk factor for serious illness; one found a statistically significant as-

sociation. Trends toward higher risk for younger infants are noted in the other three, however, and a total of six papers provide sufficient data to make a combined risk estimate. Roberts²³ reports that combining data for three of the studies^{5,9,10} in the sample gives a rate of bacteremia in the first month of life of 7.8 percent compared with 3.3 percent in the second month of life. Adding data available from three other studies^{4,11,13} to his figures, a total of 17 out of 311 one-month-old infants had bacteremia (5.5 percent) compared with 13 of 559 infants in the second month of age (2.3 percent). This greater than twofold difference is statistically significant at the .02 level (chi-square = 5.97).

Fever

Four study papers^{4,10-12} found the degree of fever predicted serious illness. In three of these^{4,11,12} a specific level of fever is used as a cutoff point in assessing risk. Although the cutoff point selected varies among the three, in each case infants with the higher fever are at significantly higher risk of serious infection than those with the lower fever. Excess risk estimates ranged from twofold to eightfold. These results are displayed in Table 6. For two studies it is possible to calculate the sensitivity and specificity of the diagnostic finding of higher fever. The sensitivity is 61 percent in one study¹² and 81 in the other,¹¹ indicating that the high fever criterion identifies a majority but not all infants with serious bacterial illness. Specificities are 61 and 72 percent, respectively, suggesting the higher fever criterion incorrectly categorizes a number of nonseriously ill infants as being at risk.

The studies also support a view that high fevers are less common among very young infants than among older babies. McCarthy and Dolan's data⁴ show that only 1.3 percent of infants under 3 months of age studied had temperatures of 40 °C or higher compared with 7.8 percent of infants 3 to 6 months old. Pantell et al³ found 10.5 percent of febrile children under 3 months of age had fevers of 38.3 °C or higher compared with 34 percent of febrile children who were 3 to 6 months old. Data from Crain and Shelov,⁹ Caspe et al,¹⁰ and Klein et al¹¹ support this notion.

White Blood Cell Count

Three studies provide evidence that white blood cell count is predictive of bacteremia or serious illness. Klein et al¹¹ note only that a statistically significant association between serious illness and white cell count greater than $10 \times 10^9/L$ ($10 \times 10^3/\mu L$) was observed. Caspe et al¹⁰ and Dagan et al¹² both found that white cell counts greater than $15 \times 10^9/L$ ($15 \times 10^3/\mu L$) were significantly associated with bacteremia. The sensitivity of the white cell count as a predictor, however, is low, only 46 percent and 52 percent, respectively, meaning many infants with potentially serious infection are not identified using the elevated white cell count criterion.

DISCUSSION

In attempting to provide data to guide management decisions, researchers frequently face the problem of estimating true values of such parameters as risk or size of treatment effect from small patient samples. Increasing sample size is a method of improving the accuracy of these estimates. Combining or pooling data from collections of studies is a technique for raising sample size that has been recently demonstrated with groups of clinical trials.²⁴⁻²⁸

Stampfer et al²⁷ reviewed eight randomized trials of intravenous streptokinase for treatment of acute myocardial infarction. Five of the studies comparing mortality of drug-treated patients with controls showed a risk ratio that favored treatment. The 95 percent confidence limits were broad enough to include a ratio of 1.0, or no effect, in three of these five studies, however. By combining data, the authors demonstrated a statistically significant 20 percent reduction in mortality among treated patients. The confidence limits of their pooled estimate (0.68 to 0.95) are considerably narrower than the limits calculated from individual studies, and strongly suggest the treatment is of value. Data pooling may show that treatments thought to be similar are, in fact, not equivalent. Philbrick and Bracikowski²⁸ reviewed results of studies of single-dose therapy of urinary tract infections. Individually the studies lacked sufficient patient numbers to demonstrate a statistically significant difference between single-dose and ten-day treatment. When data from three of the most rigorously designed studies were combined, however, the single-dose amoxicillin approach appeared to be less effective than ten-day therapy.

This article combines data from ten separate descriptive studies of young febrile children and demonstrates the use of pooling to improve estimates of infection risk. Pooled results suggest that the risk of bacteremia in infants is much closer to 3 percent overall than to the reported

15 percent that has alarmed clinicians. The pooled findings present a consistent pattern over a number of studies conducted at different sites. In seven of nine studies bacteremia occurred in fewer than 5 percent of infants.

The validity of pooled results rests on several assumptions:

1. The criteria for entry into the studies must be similar.
2. Diagnostic methods, such as blood culture and cerebrospinal fluid examinations, must be obtained consistently across studies so that infants' conditions are equally likely to be diagnosed.
3. Clinical outcomes should be comparably defined and ascertained.

The group of ten studies satisfies these assumptions remarkably well despite the mixture of prospective and chart review designs. Entry criteria are similarly defined and easily measured. All children under the ages of 2 and 3 months who had fever of a comparable level were included. (Comparison studies that included older febrile children generally set higher levels of temperature for entry.)

Most of the studies consistently applied diagnostic testing. In several of the studies blood cultures and cerebral spinal fluid examinations were performed on virtually all the infants. In two studies blood cultures were performed on only 50 percent and 20 percent of the patients. Although it is possible that cases of bacteremia went undetected when blood cultures were not obtained, it is likely that when culturing is selective, infants with the highest fevers or who appear most toxic will have cultures obtained. The conservative approach is to estimate risk based on a denominator of total patients.

Outcomes, although not defined in detail, are accepted diagnoses such as otitis media, pneumonia, and meningitis, which occur commonly in pediatric practice. Some interinstitutional and interobserver variability is inevitable in making these diagnoses. The definition of bacteremia included the same bacterial pathogens in all studies, while definitions of "serious illness" varied somewhat. Among the three studies that used combined outcome measures, bacterial meningitis and bacteremia were a part of all three definitions, with pneumonia, urinary tract infection, osteomyelitis, and severe gastroenteritis included in two out of three.

In calculating summary statistics, both mean and median estimates of risks were determined. By expressing the frequency of bacteremia and serious illness as the rate of total cases in the combined population (mean), a more precise estimate of the risk is obtained. Goldman and Feinstein²⁵ and Philbrick and Bracikowski²⁸ argue that totaling individual numerators and denominators to create a new combined percentage is the most appropriate

method of making pooled estimates. This procedure avoids giving studies with small numbers of patients undue weight in the final analysis (eg, averaging percentages would not be appropriate). On the other hand, the argument can be made that each study be treated as an individual observation of risk. By calculating the median risk, an unweighted estimate is obtained, and by providing the range, consistency of findings across studies may be addressed. Results for the ten studies showed remarkably similar estimates using both of the statistical methods. Mean and median risk estimates for bacteremia, pneumonia, and meningitis were within one to two percentage points of each other, and most ranges spanned fewer than 15 percentage points.

The rates of bacteremia and serious illness found in this review challenge the idea that infants younger than 3 months of age are at greater risk than older infants. Rates of bacteremia for studies of younger infants were approximately one half of those of the older group. Studies of older infants, however, generally used higher levels of fever as entry criteria, creating the possibility that selection bias favored the inclusion of more seriously ill older patients. In three studies that evaluated older and younger infants,^{14,15,22} bacteremia was less common among children aged less than 6 months than for older children.

The concern that clinical assessment is inadequate to identify the infants who may be seriously ill is similarly not supported by the data. Twenty-three of 25 bacteremic infants were identified by house officers as potentially septic. While Roberts and Borzy⁵ have pointed to the "limitation of clinical judgment in assessing febrile infants," combining their findings with those from two other studies demonstrates that clinical assessment is 92 percent sensitive in identifying infants at risk. Few diagnostic maneuvers in clinical medicine exceed that sensitivity. Furthermore, the features of consolability, irritability, and activity that house officers reported influenced their ratings of infant well-being are similar to those McCarthy et al²⁹ found highly sensitive in identifying older children at risk of serious illness.

These findings make the management policy of routine hospitalization and antibiotic administration difficult to justify. DeAngelis et al⁷ have identified the iatrogenic risks and financial costs of this approach. They found iatrogenic complications occurred in almost 20 percent of admissions, principally from problems resulting from intravenous solutions infiltrating and side effects of antibiotics. The average length of hospitalization for their series of 184 infants was seven days with a striking 5.3-day average length of stay for the 73 infants who had fever without focal signs and who "probably did not require hospitalization." The average cost of each admission was over \$2,000 per infant based on costs calculated in 1979-80.

Seven of the ten groups of authors comment on man-

agement strategies. Although the policy at most institutions at the time of the study was to admit and treat all infants, authors in six of the seven papers suggest a more moderate course might be reasonable; infants might be admitted and observed or admitted selectively. At the same time, several note the possibility that the prompt hospitalization and treatment of infants in these studies may have obscured the natural history of disease and prevented the development of serious illness among some infants. This argument is plausible; however, the number of infants with initially negative results on blood and cerebral spinal fluid culture who subsequently develop serious illness is probably low and might well be detected with close follow-up.

Using the clinical assessment criteria described in three studies, 302 of 500 infants (60 percent) were classified as low risk and might have been spared hospitalization. Only two (0.7 percent) were bacteremic. Dagan et al¹² gave 144 of 233 (62 percent) infants low-risk ratings and found a single case of serious bacterial infection (nonbacteremic). When Crain and Shelov⁹ used clinical impression in combination with elevated white cell count and erythrocyte sedimentation rate criteria, they correctly identified all infants with bacteremia and properly classified 79 percent of patients as low risk.

Several principles for more cost-effective management of young febrile infants are suggested by this review:

1. Infants younger than 3 months of age do not as a group appear to be at higher risk for bacteremia than older infants. The subgroup younger than 1 month of age does have a twofold increased risk (still under 10 percent) and might be a selected target for more aggressive management.
2. The clinical appearance of infants does have predictive value in identifying those with serious illness.
3. Other diagnostic features, such as height of fever and elevated white blood count, while imperfect predictors, do have value in identifying infants with serious illness.
4. Careful outpatient evaluation of young infants can identify most who are at risk of serious illness.

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