



# LONG-TERM OUTCOMES OF GROUP B STREPTOCOCCAL MENINGITIS

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## Background

- Group B Streptococcal (GBS) disease is a leading infectious cause of morbidity and mortality among newborns in the United States.
- Mortality related to GBS meningitis has been reported to be between 7% to 10%, with survivors at high risk for neurologic sequelae.
- No contemporary data are available that describe the late outcomes of GBS meningitis and the factors associated with these outcomes.

## Objective

- To investigate the long-term outcomes of GBS meningitis in term and near term infants and to evaluate possible factors associated with these outcomes.

## Methods

- Term and near term infants previously diagnosed with GBS meningitis (positive GBS cerebrospinal fluid [CSF] culture or CSF pleocytosis with positive blood culture) at Texas Children's Hospital and Monroe Carell Jr. Children's Hospital from 1998 through 2006 were contacted and asked to return for follow-up examination. Subjects who were evaluated were comparable with those who did not return for an evaluation.
- In those evaluated, physical and neurological examination, hearing and visual screening, and psychological tests were performed. Testing included WIAT II (for academic achievement in subjects 6 years of age or older) and Mullen Scales of Early Learning (for early cognitive development in children younger than 68 months of age).

## Definitions of Severity

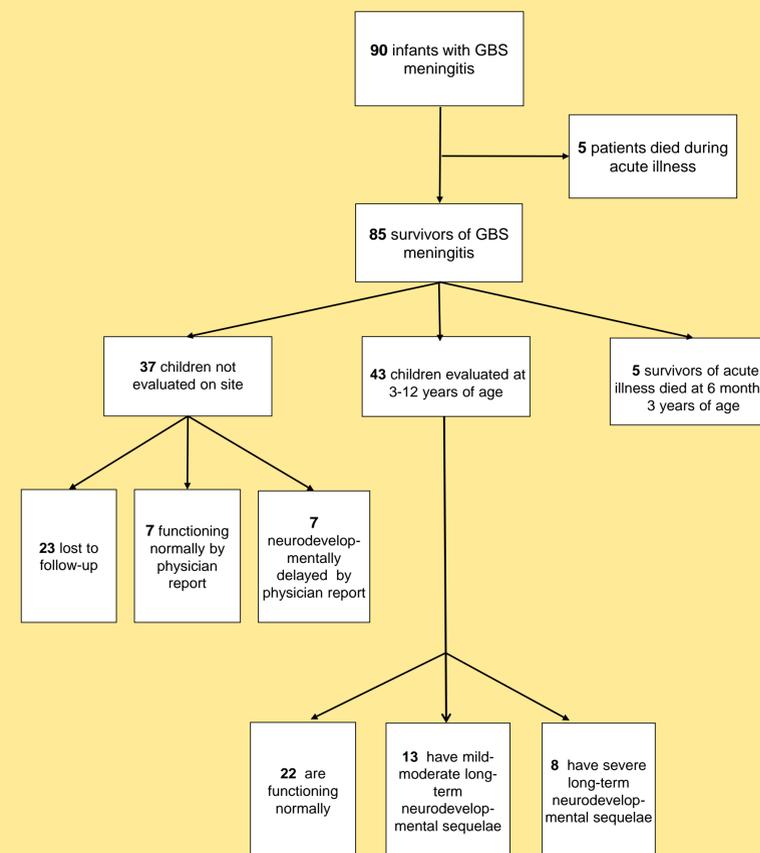
- Normal:** WIAT II standard scores, Mullen T scores, or cognitive standard scores +/- 1 standard deviation (SD) from the mean and no neurological or functional impairment.
- Mild to moderate impairment:** WIAT II scores 1-2 SD below the mean, or > 15 point split between subtest categories; Mullen T scores 1-2 SD below the mean in one or more domains or cognitive T scores between 1-2 standard deviations below the mean or evidence of mild or moderate neurological or functional impairment.
- Severe impairment:** WIAT II and Mullen T scores >2 SD below the mean in 1 or more areas of achievement or domains or evidence of severe neurological or functional impairment.

## Statistical Analysis

- Means, medians and ranges, were calculated for descriptive data.
- Univariate analysis of features predicting an adverse outcome was performed using the 2-tailed Fisher's exact test. A P value of less than 0.05 was considered statistically significant.
- Multivariate logistic regression was performed on risk factors that were associated with adverse outcome at a P ≤ 0.20.
- Analyses were conducted with STATA 8.0.

## Results

Flowchart for late outcomes of GBS meningitis study participants.



Odds ratio (OR) comparison for features associated with adverse long-term outcomes in children who had GBS meningitis.

	Any delay vs. normal OR (CI95%)	Late Death and severely impaired vs. normal OR (CI95%)
<b>Admission features</b>		
Lethargy	6.1 (1.4-26.6)	13 (1.8-∞)
Respiratory Distress	1.8 (0.5-5.9)	12 (1.3-110.5)
Coma or semicoma	2.1 (0.5-8.5)	6 (1.2-29)
Seizures	3 (0.8-11.3)	7.5 (1.4-39.8)
Bulging fontanel	4.5 (1.2-17.9)	10 (1.1-92)
<b>Laboratory tests at admission</b>		
CSF proteins > 300 mg/dL	2.9 (0.7-11.7)	9.9 (1.7-56.3)
CSF glucose < 20 mg/dL	1.8 (0.5-5.9)	6.5 (1.1-38.6)
<b>Hospital course</b>		
Ventilatory support	4.9 (1.2-19.3)	37.5 (3.6-386.5)
Pressor support	6.5 (1.5-27.8)	33 (4.7-229.6)
<b>Discharge features</b>		
Abnormal neurological exam	15.4 (1.8-132.4)	70 (6.4-760.3)
Failed hearing screening	7.4 (0.96-∞)	14.7 (1.7-∞)
End of therapy abnormal image	4.1 (0.99-16.9)	12.6 (1.3-123.5)
First and end therapy abnormal image	4.8 (1.1-20.3)	7.3 (1.3-42.3)

Definition criteria for long-term sequelae in children with GBS meningitis

Severe impairment (8)	Mild to moderate impairment (13)
Profound global developmental delay (8)	Mild to moderate learning disability (11)
Hydrocephalus (2)	Mild to moderate developmental delay (5)
Cortical visual impairment (4)	Delayed problem-solving and fine motor skills (1)
Bilateral sensorineural deafness (4)	Persistent asymptomatic seizure disorder (3)
Cerebral palsy / spasticity (5)	Hydrocephalus with VP shunt (1)
Persistent symptomatic seizures (4)	Loss of terminal digit of right thumb and right forefinger (1)

## Conclusions

- Long term morbidity among survivors is substantial. Approximately one-half of our patients had some impairment.
- Factors on admission associated with death or severe impairment included lethargy, respiratory distress, coma or semicoma, seizures, bulging fontanel, leukopenia, acidosis, CFS proteins>300 mg/dL, CSF glucose<20 mg/dL, need for ventilatory support or need for pressor support.
- At discharge children who failed the hearing screening, had an abnormal neurological exam, or had abnormal brain imaging were also at increased risk for death or abnormal developmental examinations.

## Implications

- Despite intrapartum GBS prophylaxis, survivors of GBS meningitis continue to have substantial long-term morbidity.
- These results highlight the need for awareness in the pediatric community about the adverse outcomes in children with GBS meningitis.
- These outcomes highlight the need for prevention strategies that could prevent early- and late-onset meningitis, such as maternal immunization.

## Acknowledgments

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