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**Original Article**

# Correlation Between Positive Gastric Aspirate Cytology And Early Onset Sepsis With Early Neonatal Warning Score

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**Abstract:**
**Objective:** To Evaluate The Correlation Between Positive Gastric Aspirate Cytology And Early Neonatal Sepsis; To Assess The Relationship Between Gastric Aspirate Cytology Results And Early Onset Neonatal Warning Signs. **Methods:** This Hospital-Based Prospective Study Was Conducted At The Department Of Pediatrics, Muzaffarnagar Medical College, Over 18 Months. The Study Included 45 Newborns Exhibiting Risk Factors For Sepsis. Gastric Aspirate Cytology Was Performed Before The First Feeding, And Its Results Were Correlated With Clinical Signs Of Sepsis And Laboratory Findings. Statistical Analysis Involved Chi-Square Tests For Categorical Data And T-Tests For Continuous Variables. **Result And Conclusion:** The Study Found That 46.7% Of The Gastric Aspirate Samples Tested Positive For Cytological Signs Of Infection. There Was A Significant Correlation Between Positive Gastric Aspirate Results And Confirmed Sepsis Cases. The Neonatal Early Warning Score Also Showed Significant Associations With Positive Cytology Results, Indicating Its Potential Utility In Predicting Sepsis.

**Keywords:** Gastric Aspirate Cytology; Sepsis; Late Preterm; Term; Hospital Stay.



## Introduction:

Neonatal Sepsis, A Clinical Syndrome Characterized By Systemic Signs And Symptoms Of Infection During The First Month Of Life, Poses A Significant Threat, Accounting For 30-50% Of Neonatal Deaths Annually In Developing Countries. [1,2] According To The National Neonatal Perinatal Database For The Years 2002-2003, The Incidence Of Neonatal Sepsis In India Was Reported As 30 Per 1000 Live Births. The Urgency Of Early Detection And Intervention In Neonatal Sepsis Cannot Be Overstated As It Plays A Crucial Role In Averting Severe Morbidity And Mortality Associated With The Condition.[3,4]

In The Realm Of Neonatal Sepsis Screening, Various Parameters Such As Leucopenia Or Leucocytosis, Toxic Granules, Immature Neutrophil To Total Neutrophil Ratio, Micro-Esr, And C-Reactive Protein Have Been Established[5]. Despite The Existence Of These Screening Parameters, The Medical Community Consistently Seeks Parameters With Optimal Sensitivity And Specificity[6].

Recognizing The Need For Continual Refinement In Screening Methodologies For Neonatal Sepsis, This Study Focuses On The Underexplored Potential Of Gastric Aspirate Cytology, Offering A Fresh Perspective On Its Utility As A Screening Tool. In The Realm Of Neonatal Care, The Significance Of Promptly Distinguishing Between Infected And Noninfected Infants, Particularly During The Early Stages Of Newborn Life, Cannot Be Overstated[7]. This Underscores The Urgent Need For Rapid Diagnostic Tests That Can Effectively Discern The Presence Of Infection In This Vulnerable Population. Such Diagnostic Tools Hold The Potential To Revolutionize Neonatal Care Practices[8].

While Blood Cultures Stand As The Gold Standard In Diagnosing Newborn Sepsis, Their Utility Is Hindered By Certain Limitations, Such As Low Sensitivity And A Considerable Reporting Delay Ranging From 24 To 72 Hours. Recognizing These Drawbacks, There Is A Pressing Demand For Procedures Aimed At Enhancing The Sensitivity And Specificity[9].

The Optimal Early Diagnostic Test For Detecting Infections Is One That Boasts 100% Sensitivity, Ensuring The Identification Of All Individuals Afflicted With The Disease, And 100% Specificity, Guaranteeing That All Individuals Without The Disease Receive A Negative Test Result. However,

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The Realization Of Such An Ideal Test Remains Improbable.

Gastric Aspirate Cytology Has Long Been Recognized As A Cost-Effective Technique Employed Primarily For The Evaluation Of Risk Factors, Serving As An Indicator Of Potential Exposure To Intrauterine Infections. This Procedure, Performed In A Peripheral Setting, Holds Significant Value Due To Its Affordability And Accessibility. By Conducting This Assessment Prior To The Baby's First Feed, Valuable Insights Can Be Gleaned At An Early Stage . This Method Not Only Stands The Test Of Time But Also Provides A Practical And Timely Means Of Identifying Potential Risks Associated With Intrauterine Infections. The Simplicity And Efficiency Of Gastric Aspirate Cytology Make It A Valuable Tool In The Realm Of Risk Assessment, Contributing To The Overall Well-Being And Early Intervention For Newborns[13]

The Correlation Between Gastric Aspiration Cytology And The Neonatal Early Warning Score Presents An Opportunity To Significantly Reduce Neonatal Mortality And Morbidity Rates. Implementing This Approach Not Only Aids In The Timely Identification Of Potential Sepsis Cases But Also Allows For Prompt Intervention, Ultimately Contributing To Improved Outcomes For Neonates. Therefore, The Integration Of Gastric Aspiration Before Feeding Into Neonatal Care Protocols Emerges As A Valuable Strategy In Enhancing The Overall Healthcare Management Of Newborns[14]

**Material And Methods:**

Hospital Based Study Conducted In Nicu Of Muzaffarnagar Medical College; Muzaffarnagar Up. Study Duration Was 18 Month, Started From August 2022; Sample Size Was 45 Newborns; Which Were Fulfilling The Inclusion Criteria.

**Inclusion Criteria**

- Neonates With Risk Factor For Sepsis
- Neonates With Risk Factor Of Sepsis

**Exclusion Criteria-**

- Breastfed Or Formula Fed Infants
- Mother Taken Antibiotics <4 Hour Before Delivery
- Antibiotics Given To The Newborns Before The Procedure

**A Practical Sepsis Screen**

| Components | Abnormal Value |
|---|---|
| Total leukocyte count | <5000/mm$^3$ |
| Absolute neutrophil count | Low counts as per Manroe Chart[21] for term and Mouzinho's chart[22] for VLBW infants |
| Immature/ total neutrophil | >0.2 |
| Micro-ESR | >15mm in 1$^{st}$ hour |
| C reactive protein (CRP) | >1mg/dL |

Proper Consent Was Obtained. The Demographic Details Of The Mother And Neonate, Along With Examination Findings And Required Investigations, Were Noted In A Predesigned And Validated Proforma. Gestational Age Was Assessed Using The Last Menstrual Period And The New Ballard's Score. Various Investigations, Including Haemoglobin(Hb), TlcDlc, Platelet Count, Crp (Quantitative), Esr, And Blood Culture, Were Sent For All The Neonates, And The Results Were Recorded.

Gastric Aspirate Was Collected Using An Infant Feeding Tube Of 5-6 Fr Before The Initiation Of Feeding, Preferably Within The First Hour After Birth, And Within 6 Hours Of Birth, 5ml Of Gastric Aspirate Was Obtained In Two Sterile Bottles Through A Nasogastric Tube; One For Smear With A Drop Of Heparin (Clearing Agent) And The Other For Culture And Sensitivity. The Gastric Aspirate Was Centrifuged, And A Drop Of It Was Spread On A Clean Glass Slide With The Help Of Another Glass Slide. The Smear Was Stained With Leishman Stain And Examined For Polymorphonuclear Leukocytes Under Light Microscopy At High Power Field (100x) In Five Consecutive Fields, With An Average Taken. The Other Gastric 50 Microliter Aspirate Was Centrifuged, And 25 Microliters Of Methylene Blue Were Added And Examined As A Wet Film. Presence Of 5 Polymorphs Per High Power Field Or More Than 75% Polymorphs To Epithelial Ratio Was Considered Positive.

Strict Monitoring Of Neonatal Early Warning Score Was Performed, With Respiratory Rate, Oxygen Saturation, Temperature, And Heart Rate Being Noted. Probable Sepsis Was Defined As When Clinical And Laboratory (Sepsis Screen) Findings Were Consistent With Bacterial Infections But Blood Culture Was Sterile. In Cases Where The Initial Screen Was Negative, It Was Repeated After 12 To 24 Hours When Clinical Suspicion Of Infection Was Strong. If The Repeat Sepsis Screen Was Also Negative, The Diagnosis Of Sepsis Could Be Excluded With Reasonable Certainty. For Culture

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Proven Sepsis, Blood Culture Was Taken Before Starting Antimicrobial Therapy, With The Venepuncture Site Overlying A Peripheral Vein Being Thoroughly Sterilized Before Obtaining The Blood Specimen. One MilliliterOf Blood In 10 To 20 Ml Of Broth For Blood Culture Was Taken.

The Relation Between Gastric Aspirate Cytology, Neonatal Early Warning Score, And Sepsis Was Carefully Noted AndAnalyzed.The Statistical Significance Of The Difference In The Rate Of An Outcome Between The Two Groups Was Assessed By The Chi-Square Test

**Results And Discussion:**

**Association Between Gestational Age And Gastric Aspirate Cytology**

| Gestational Age | Gastric Aspirate Cytology | | | | Total | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | | |
| | N | % | N | % | N | % |
| **Pre-Term** | 9 | 64.3 | 5 | 35.7 | 14 | 31.1 |
| **Term** | 12 | 38.7 | 19 | 61.3 | 31 | 68.9 |
| **Total** | **21** | **46.7** | **24** | **53.3** | **45** | **100.0** |

**$X^2$ = 2.535 Df = 1 P-Value** = 0.111

The Above Table Represents The Results Of Gastric Aspirate Cytology Across Different Gestational Ages. Among Pre-Term Infants, 64.3% Tested Positive And 35.7% Tested Negative, Contributing To A Total Of 31.1% Of Cases. In Contrast, Among Term Infants, 38.7% Tested Positive And 61.3% Tested Negative, Comprising 68.9% Of Cases. Overall, 46.7% Of Cases Were Positive And 53.3% Were Negative, With A Chi-Square Test Showing No Significant Difference Between Pre-Term And Term Infants (X2 = 2.535, Df= 1, P-Value = 0.111).**Mandlik A Et Al.,**[16] Examined The Relationship Between Septicemia, Positive Gastric Aspirate, And Gender Distribution Among Newborns Also Showed Similar Results, But It Also Determined This Indicates That A Higher Percentage Of Preterm Infants Developed Septicemia Compared To Full-Term Infants (59.37% Vs. 47.22%), And A Slightly Higher Percentage Of Preterm Infants Tested Positive For Gastric Aspirat

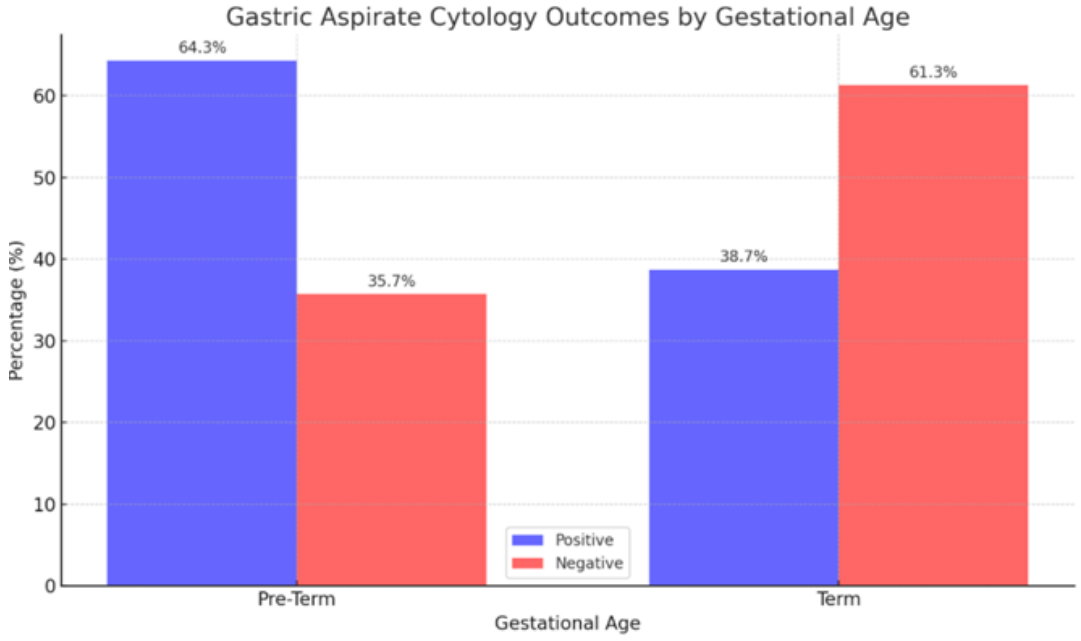


**Table 2: Association Between Birth Weight And Gastric Aspirate Cytology**

| Birth Weight | Gastric Aspirate Cytology | | | | Total | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | | |
| | N | % | N | % | N | % |
| **<2.5 Kg** | 7 | 41.2 | 10 | 58.8 | 17 | 37.8 |
| **>2.5 Kg** | 14 | 50.0 | 14 | 50.0 | 28 | 62.2 |
| **Total** | **21** | **46.7** | **24** | **53.3** | **45** | **100.0** |

**$X^2$ = 0.331 Df = 1 P-Value** = 0.565

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The Above Table Represents The Distribution Of Birth Weight And Gastric Aspirate Cytology Results Among Infants. The Data Reveals That Among Infants Weighing Less Than 2.5 Kg At Birth, 41.2% Tested Positive For Gastric Aspirate Cytology, While 58.8% Tested Negative. In Contrast, Among Infants Weighing More Than 2.5 Kg At Birth, 50.0% Tested Positive And 50.0% Tested Negative. Overall, Out Of The Total Sample Of 45 Infants, 46.7% Tested Positive For Gastric Aspirate Cytology, While 53.3% Tested Negative. The Chi-Square Test Indicated No Significant Association Between Birth Weight And Gastric Aspirate Cytology Results (X2 = 0.331, Df = 1, P-Value = 0.565).

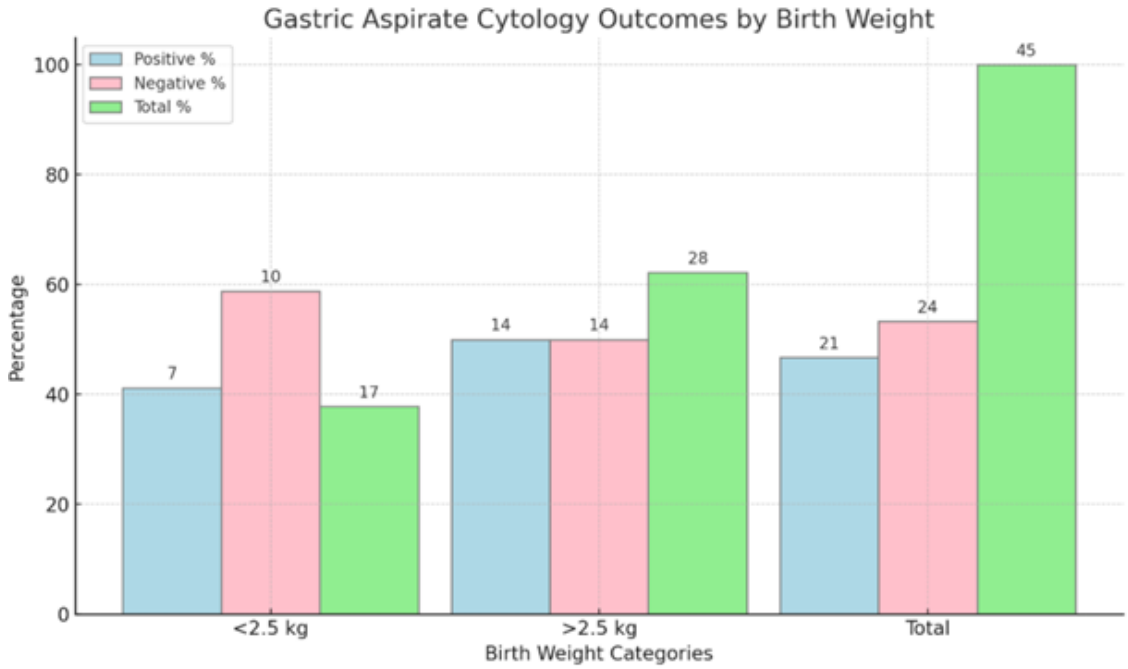


**Table 3: Association Between Sepsis Status And Gastric Aspirate Cytology**

| Sepsis | Gastric Aspirate Cytology | | | | Total | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | | |
| | N | % | N | % | N | % |
| Confirmed Sepsis | 6 | 66.7 | 3 | 33.3 | 9 | 20.0 |
| Probable Sepsis | 12 | 63.2 | 7 | 36.8 | 19 | 42.2 |
| No Sepsis | 3 | 17.6 | 14 | 82.4 | 17 | 37.8 |
| **Total** | **21** | **46.7** | **24** | **53.3** | **45** | **100.0** |

**$X^2$ = 9.275 Df = 2 P-Value = <0.01**

The Above Table Represents The Results Of Gastric Aspirate Cytology In Patients Suspected Of Sepsis. The Table Is Structured To Compare The Presence Of Sepsis (Confirmed Or Probable) Against Negative Cases. Out Of The Total 45 Cases, 9 (20.0%) Were Confirmed To Have Sepsis, With 6 (66.7%) Showing Positive Cytology. In The Probable Sepsis Category, Comprising 19 (42.2%) Cases, 12 (63.2%) Tested Positive. Conversely, Among The 17 (37.8%) Cases With No Sepsis, Only 3 (17.6%) Showed Positive Results. Overall, The Data Suggest A Significant Association Between Sepsis And Positive Gastric Aspirate Cytology (X2 = 9.275, Df = 2, P-Value < 0.01.

**Association Between Neonatal Early Warning Score And Gastric Aspirate Cytology**

| Neonatal Early Warning Score | Gastric Aspirate Cytology | | | | Total | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | | |
| | N | % | N | % | N | % |
| Low Risk | 5 | 22.7 | 17 | 77.3 | 22 | 48.9 |
| Moderate Risk | 9 | 60.0 | 6 | 40.0 | 15 | 33.3 |
| High Risk | 7 | 87.5 | 1 | 12.5 | 8 | 17.8 |
| **Total** | **21** | **46.7** | **24** | **53.3** | **45** | **100.0** |

**$X^2$ = 11.497 Df = 2 P-Value = <0.01**

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The Above Table Represents The Distribution Of Neonatal Early Warning Score (News) And Gastric Aspirate Cytology Results Among Infants Categorized Into Low, Moderate, And High-Risk Groups. Among Those Classified As Low Risk, 22.7% Had Positive Gastric Aspirate Cytology Results, While 77.3% Had Negative Results, Comprising 48.9% Of The Total Low-Risk Group. In The Moderate-Risk Category, 60.0% Tested Positive For Gastric Aspirate Cytology, With 40.0% Testing Negative, Accounting For 33.3% Of The Total Moderate-Risk Group. Conversely, The High-Risk Group Showed A Higher Proportion Of Positive Results, With 87.5%, While Only 12.5% Had Negative Results, Constituting 17.8% Of The Total High-Risk Group. Overall, The Analysis, Characterized By A Chi-Square Test ($X2 = 11.497$, $Df = 2$, $P\text{-Value} < 0.01$), Indicates Significant Associations Between Neonatal Early Warning Score And Gastric Aspirate Cytology Findings, Suggesting Potential Predictive Value Of These Parameters In Neonatal Health Assessment. Our Study Showed Similar Results With **Gebremariam H Et Al.,**[15]which Explored The Correlation Between Positive Gastric Aspirate Cytology And Early Onset Sepsis With Early Neonatal Warning Scores.

**Conclusion:**

- Gastric Aspirate Cytology Results Showed Nearly Equal Distribution Between Positive (46.7%) And Negative (53.3%) Outcomes, Providing Diagnostic Insights.
- The Distribution Of Sepsis Status Indicated That 42.2% Of The Subjects Were Classified Under Probable Sepsis, Highlighting The Need For Vigilant Monitoring And Treatment.
- The Neonate Early Warning Score Analysis Pointed To A Significant Proportion Of Neonates At Moderate And High Risk, Stressing The Importance Of Early Intervention.
- Gastric Aspirate Cytology And Sepsis Status Demonstrated Significant Associations, With Confirmed Sepsis Cases More Likely To Yield Positive Cytology Results.

**Conflict Of Interest:** The Author Declares No Conflict Of Interest.

**Ethical Approval:**The Study Was Approved By The Institutional Ethics Committee.

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