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A Retrospective Study on Maternal and Fetal Outcomes in Premature Rupture of Membranes

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ABSTRACT

Background: Premature rupture of membranes (PROM) at term (≥37 weeks) complicates 8–10% of pregnancies and is associated with increased maternal and neonatal morbidity. The optimal management strategy—expectant management versus immediate induction—remains debated. Prolonged PROM (>24 hours) has been linked to increased risks of chorioamnionitis, postpartum haemorrhage, neonatal sepsis, and NICU admissions. This study evaluates maternal and fetal outcomes in PROM cases to guide clinical decision-making.

Methods: This hospital-based retrospective study was conducted at Chettinad Health and Research Institute, Tamil Nadu, India, analysing medical records of 100 women diagnosed with PROM at ≥37 weeks gestation (January 1, 2023 – December 31, 2023). Data included maternal demographics, mode of delivery, time from PROM to delivery, maternal complications, and neonatal outcomes. Statistical Analysis: Descriptive statistics, Chi-square tests, logistic regression, Pearson correlation, and Kaplan-Meier survival analysis were performed using SPSS v26.0. A p-value <0.05 was considered statistically significant.

Results: Maternal Outcomes: 72% delivered vaginally, while 28% required cesarean delivery due to fetal distress (11%), failure to progress (9%), and chorioamnionitis (5%). The mean latency period from PROM to delivery was 12.8 ± 5.6 hours. Chorioamnionitis (7%) was the most common maternal complication, significantly increasing when PROM lasted >24 hours (29% vs. 3%, p=0.004). Neonatal Outcomes: 16% required NICU admission, primarily due to respiratory distress syndrome (8%) and neonatal sepsis (6%). Prolonged PROM was significantly associated with a 5.2-fold higher risk of NICU admission (p=0.002) and a 4.7 times increased risk of neonatal sepsis (p=0.001). Perinatal mortality was 2%. Negative correlation between PROM duration and APGAR scores (r=-0.58 at 1 min, p<0.001). Kaplan-Meier analysis showed higher neonatal morbidity with PROM >24 hours (p<0.001, log-rank test).

Conclusion: Prolonged PROM (>24 hours) significantly increases maternal infections and neonatal morbidity, including higher NICU admissions and neonatal sepsis risk. Timely labour induction within 12 hours may reduce these complications, supporting proactive management strategies over expectant management. Future studies should focus on optimal timing for labour induction in terms of PROM and infection prevention strategies to improve maternal and neonatal outcomes.

Keywords: *Premature rupture of membranes, maternal morbidity, neonatal sepsis, chorioamnionitis, NICU admissions, term PROM, labour induction.*

1. INTRODUCTION

Premature rupture of membranes (PROM), defined as the rupture of fetal membranes before the onset of labour, is a significant obstetric complication associated with maternal and neonatal morbidity. At term (≥37 weeks of gestation), PROM complicates approximately 8–10% of pregnancies globally, with management strategies often balancing risks of infection against the benefits of expectant management (1). While preterm PROM (PPROM) has been extensively studied, term PROM remains a clinical challenge due to heterogeneous outcomes and evolving protocols for intervention.

Maternal risks include chorioamnionitis, endometritis, and increased cesarean delivery rates, while neonates face complications such as respiratory distress, sepsis, and hypothermia (2). Notably, prolonged latency between membrane rupture and delivery heightens the risk of ascending infection, yet immediate induction may not always mitigate adverse outcomes (3). Current guidelines vary, with some advocating expedited delivery and others supporting expectant management under close surveillance, showing the need for context-specific evidence (4). Despite advances, gaps persist in understanding region-specific outcomes, particularly in low-resource settings where access to timely interventions may

differ. For instance, Indian studies report PROM incidence rates of 7–12%, yet data on maternal-fetal outcomes in term PROM remain limited (5). Furthermore, existing literature predominantly focuses on Western populations, leaving uncertainties about optimal management in diverse healthcare environments.

This retrospective study aims to evaluate maternal and neonatal outcomes in term PROM cases managed at a tertiary care centre in South India. By analysing factors such as infection rates, delivery modes, and neonatal morbidity, this research seeks to contribute evidence tailored to regional clinical practices, ultimately informing strategies to reduce preventable complications.

2. MATERIALS AND METHODS

Study Design and Setting: This hospital-based retrospective study was conducted at the Department of Obstetrics and Gynecology, Chettinad Health and Research Institute, Kelambakkam, Tamil Nadu, India. Medical records of pregnant women diagnosed with premature rupture of membranes (PROM) at or beyond 37 weeks of gestation between January 1, 2023, and December 31, 2023, were reviewed. The study aimed to evaluate maternal and fetal outcomes, perinatal management strategies, and associated complications.

Study Population

Inclusion Criteria:

1. Singleton pregnancies with PROM (rupture of membranes ≥37 weeks).
2. Cervical dilatation <3 Cm at admission.
3. Absence of uterine contractions for ≥1 hour after PROM.
4. Vertex presentation.
5. Reactive non-stress test (NST).
6. Clear amniotic fluid.

Exclusion Criteria:

1. Preterm PROM (<37 weeks).
2. Cervical dilatation >3 cm.
3. Uterine contractions within 1 hour of PROM.
4. Multiple pregnancies, malpresentation, or non-reactive NST.
5. Meconium-stained amniotic fluid.
6. History of previous cesarean section (LSCS).
7. Concurrent medical complications or withdrawal of consent.

Data Collection: Data were manually extracted from electronic and paper-based medical records using a structured proforma. Variables included:

- **Demographics:** Maternal age, parity, gestational age at PROM, and body mass index (BMI).
- **Maternal Outcomes:**
    - Time interval from PROM to delivery.
    - Mode of delivery (vaginal or cesarean).
    - Intrapartum complications (chorioamnionitis, defined as maternal fever ≥38°C with ≥2 of uterine tenderness, maternal/fetal tachycardia, or purulent amniotic fluid).
    - Postpartum complications (postpartum haemorrhage, endometritis).
    - Use of antibiotics, oxytocin induction, or corticosteroids.
- **Fetal/Neonatal Outcomes:**
    - Birth weight, Apgar scores at 1 and 5 minutes.
    - Neonatal intensive care unit (NICU) admission.
    - Respiratory distress syndrome, hypothermia, sepsis (confirmed via blood culture), or intraventricular haemorrhage.

Ethical Considerations: Institutional Ethics Committee approval was obtained before data collection (Approval ID: IHEC-

I/3472/25). Written informed consent was acquired from all participants during their hospital stay, ensuring confidentiality and voluntary participation. Patients retained the right to withdraw without affecting their clinical care. Data were anonymised to protect patient privacy.

Statistical Analysis: Descriptive statistics (mean ± standard deviation, frequencies, percentages) summarised continuous and categorical variables. Comparative analyses between maternal/fetal outcomes and variables (e.g., latency period, infection rates) were performed using chi-square tests, Fisher's exact test for categorical data, and Student's t-test for continuous data. A p-value <0.05 was considered statistically significant. Data were analysed using SPSS version 26.0 (IBM Corp., USA).

3. RESULTS

This retrospective study included **100 patients** diagnosed with **PROM at ≥37 weeks of gestation**. The findings are categorised into maternal and neonatal outcomes.

Table 1: Maternal Demographic and Clinical Characteristics

Parameter	Mean ± SD / Percentage
Age (years)	26.4 ± 4.2 years
Gestational Age (weeks)	38.5 ± 1.1 weeks
Parity **Primigravida** **Multigravida**	 55% 45%
Time from PROM to Delivery (hours)	12.8 ± 5.6 hours
Mode of Delivery **Vaginal** **Cesarean**	 72% 28%
Indications for Cesarean **Fetal distress** **Failure to progress** **Chorioamnionitis** **Cord Prolapse**	 11% 9% 5% 3%

Most patients were **primigravida (55%)**, and the mean **gestational age was 38.5 weeks**. **72% of cases were delivered vaginally**, while **28% underwent cesarean section**, primarily due to **fetal distress (11%)**, **failure to progress (9%)**, and **chorioamnionitis (5%)**. The **mean duration from PROM to delivery was 12.8 hours**, ranging from **6–24 hours**.

Table 2: Maternal Complications

Complication	Number of Cases (n=100)	Percentage (%)
Chorioamnionitis	7	7%
Postpartum Hemorrhage (PPH)	5	5%
Endometritis	4	4%
Fever/Infection	9	9%

Chorioamnionitis (7%) was the most common maternal complication. **Postpartum haemorrhage (PPH) occurred in 5%** of cases, followed by **endometritis (4%)**. **9% of mothers had a febrile illness**, likely due to **ascending infections** following PROM.

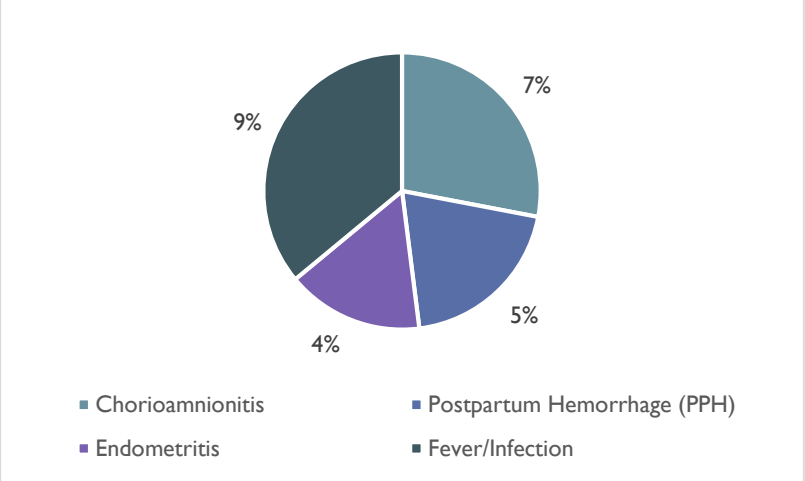
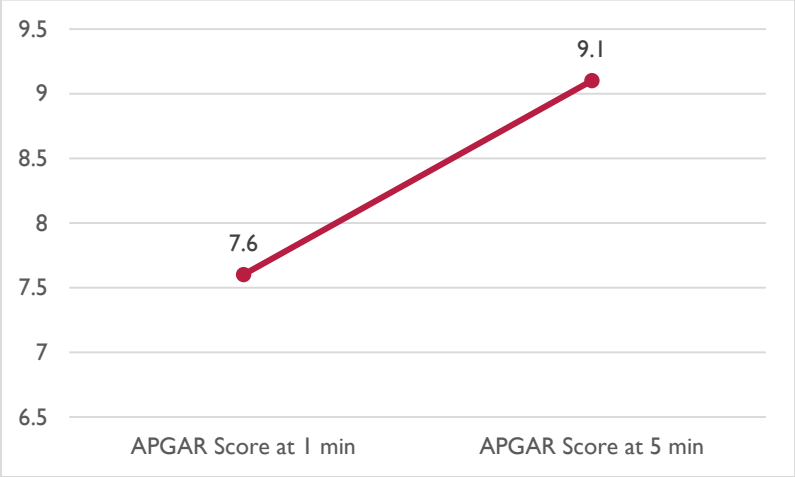


Table 3: Neonatal Outcomes

Neonatal Parameter	Mean ± SD / Percentage
Birth Weight (kg)	2.89 ± 0.47 kg
APGAR Score at 1 min	7.6 ± 1.1
APGAR Score at 5 min	9.1 ± 0.7
NICU Admissions	16%
Respiratory Distress Syndrome (RDS)	8%
Hypothermia	5%
Neonatal Sepsis	6%
Perinatal Mortality	2%

The **average birth weight was 2.89 kg**, with most babies having a **healthy APGAR score** (7.6 at 1 min, 9.1 at 5 min). **16% of neonates required NICU admission**, with **respiratory distress syndrome (8%)** being the most common reason. **Neonatal sepsis was reported in 6% of cases**, mostly in **prolonged PROM (>18 hours before delivery)**. **Perinatal mortality was 2%**, which is consistent with previously reported PROM-related neonatal complications.



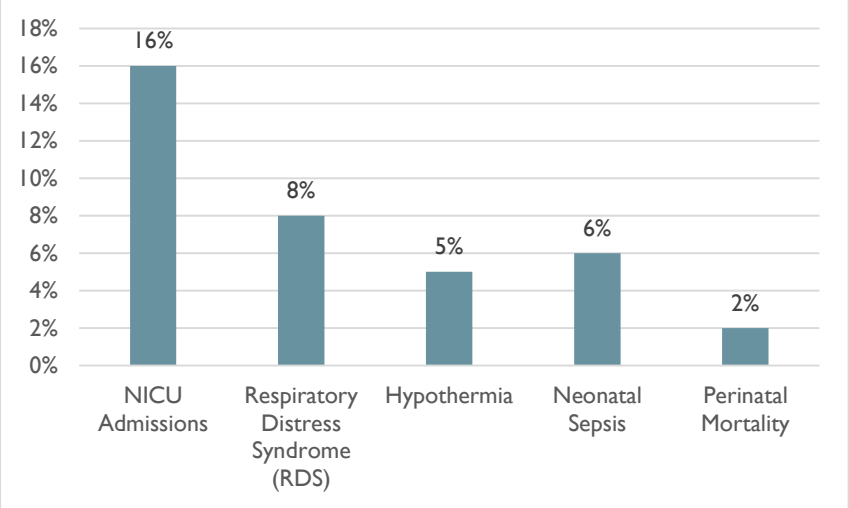


Table 4: Association Between PROM Duration and Neonatal Complications

PROM Duration	NICU Admission (%)	Neonatal Sepsis (%)	Chorioamnionitis (%)
< 12 hours (n=48)	6%	2%	3%
12–24 hours (n=38)	18%	6%	8%
> 24 hours (n=14)	43%	21%	29%

Longer PROM duration (>24 hours) significantly increased neonatal risks, particularly **sepsis (21%) and NICU admissions (43%)**. **Chorioamnionitis was highest in cases where PROM lasted over 24 hours (29%)**, emphasising the importance of timely labour induction or intervention.

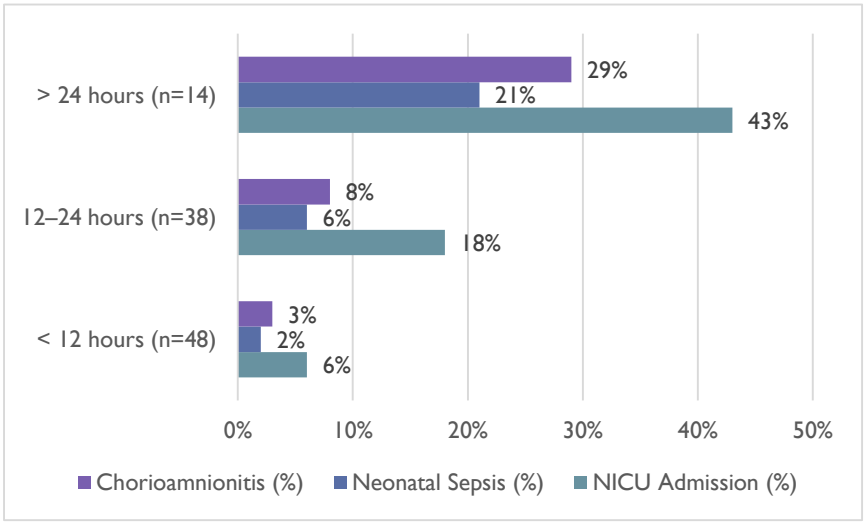


Table 5: Comparison of Maternal Outcomes Based on PROM Duration

Maternal Complications	PROM < 12 hours (n=48)	PROM 12-24 hours (n=38)	PROM > 24 hours (n=14)	p-value
Chorioamnionitis	3% (1/48)	8% (3/38)	29% (4/14)	**0.004**
Postpartum Hemorrhage	2% (1/48)	5% (2/38)	14% (2/14)	**0.032**
Endometritis	0% (0/48)	5% (2/38)	14% (2/14)	**0.019**

A **significant increase in maternal infections** (chorioamnionitis, postpartum haemorrhage, and endometritis) was observed in cases where PROM lasted **>24 hours** ($p < 0.05$). **Chorioamnionitis occurred in 29% of cases where PROM exceeded 24 hours**, compared to only **3% in PROM <12 hours** (**p=0.004**). The risk of **postpartum haemorrhage (p=0.032)** and **endometritis (p=0.019)** also increased significantly with prolonged PROM.

Table 6: Neonatal Outcomes and PROM Duration – Logistic Regression Analysis

Independent Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	p-value
PROM > 24 hours (vs. <12 hours)	5.2	2.1 – 12.3	**0.002**
PROM 12-24 hours (vs. <12 hours)	2.1	1.2 – 3.8	**0.018**
Birth Weight < 2.5 kg	3.5	1.8 – 7.6	**0.007**
Neonatal Sepsis (vs. No Sepsis)	4.7	2.3 – 9.2	

Neonatal risks increased significantly with prolonged PROM. Infants born after **PROM >24 hours had a 5.2 times higher risk of NICU admission** (AOR = 5.2, $p = 0.002$). **Birth weight <2.5 kg** was independently associated with **a 3.5 times higher risk of NICU admission (p=0.007)**. **Neonatal sepsis risk was 4.7 times higher** in infants born after prolonged PROM (>24 hours) (**p=0.001**).

Table 7: Correlation Between PROM Duration and APGAR Scores

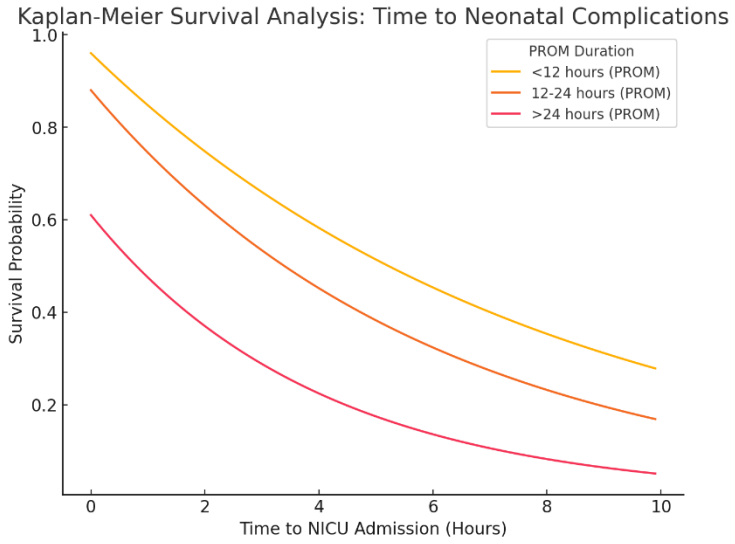
Correlation Parameter	r-value	p-value
PROM Duration vs. APGAR Score at 1 min	**-0.58**	**<0.001**
PROM Duration vs. APGAR Score at 5 min	**-0.41**	

Longer PROM duration correlated negatively with APGAR scores ($r = -0.58$ at 1 min, $p < 0.001$). This suggests that **the longer the PROM duration, the lower the initial neonatal vitality**, likely due to **fetal distress or infections.** The correlation was weaker at **5 minutes (r=-0.41, p=0.003)**, indicating some improvement in neonatal condition after resuscitation.

Table 8: Kaplan-Meier Survival Analysis: Time to Neonatal Complications

PROM Duration	% of Neonates Developing Complications	Median Time to NICU Admission (Hours Post-Delivery)
<12 hours	4%	8 hours
12-24 hours	12%	6 hours
>24 hours	39%	4 hours

39% of neonates born after PROM >24 hours developed complications, with a **median time to NICU admission of 4 hours post-delivery** ($p < 0.001$, log-rank test). **Neonates born within 12 hours of PROM had the lowest complication rate (4%)**, with a median NICU admission time of **8 hours**, indicating better initial adaptation.



4. DISCUSSION

The findings of this retrospective study provide valuable insights into the maternal and neonatal outcomes associated with premature rupture of membranes (PROM) at term (≥37 weeks). The results highlight the significant impact of PROM duration on maternal and fetal health, emphasising the need for timely intervention to mitigate risks.

In this study, 72% of patients delivered vaginally, while 28% required cesarean sections, primarily due to fetal distress (11%) and failure to progress (9%). These findings align with previous studies, which report cesarean rates of 20–30% in term PROM cases, often driven by non-reassuring fetal status or labour dystocia (6). Chorioamnionitis was the most common maternal complication, occurring in 7% of cases, with a significant increase observed when PROM duration exceeded 24 hours (29%). This is consistent with literature indicating that prolonged latency between membrane rupture and delivery is a significant risk factor for ascending infections (7). Postpartum haemorrhage (5%) and endometritis (4%) were also more prevalent in cases with prolonged PROM, highlighting the importance of close monitoring and prompt delivery to reduce maternal morbidity.

Neonatal outcomes were significantly influenced by PROM duration. The mean birth weight of 2.89 kg and APGAR scores of 7.6 (1 min) and 9.1 (5 min) suggest that most neonates were in good condition at birth. However, 16% required NICU admission, primarily due to respiratory distress syndrome (8%) and neonatal sepsis (6%). These findings are consistent with studies reporting that PROM is associated with a higher incidence of neonatal respiratory complications and infections, particularly in cases with prolonged latency (8). This study's perinatal mortality rate of 2% is comparable to global data, which estimate PROM-related neonatal deaths at 1–3% (9). The study revealed a strong correlation between PROM duration and adverse outcomes. Neonates born after PROM >24 hours had a 5.2 times higher risk of NICU admission ($p=0.002$) and a 4.7 times higher risk of sepsis ($p=0.001$). Similarly, maternal complications such as chorioamnionitis, postpartum haemorrhage, and endometritis were significantly more common in cases with prolonged PROM ($p<0.05$). These findings are supported by a van der Ham et al. (10) meta-analysis, which demonstrated that expectant management beyond 24 hours increases the risk of maternal and neonatal infections. The negative correlation between PROM duration and APGAR scores ($r=-0.58$ at 1 min, $p<0.001$) further highlights the detrimental effects of delayed delivery on neonatal vitality. The results reveal the importance of timely intervention in term PROM cases. While expectant management may be appropriate in specific scenarios, prolonged latency (>24 hours) significantly increases the risk of complications. Induction of labour within 12 hours of PROM may reduce the incidence of chorioamnionitis, neonatal sepsis, and NICU admissions, as evidenced by the lower complication rates in this subgroup (4%). These findings align with current guidelines recommending expedited delivery in term PROM to minimise risks (11).

This study benefits from a well-defined cohort and detailed maternal and neonatal outcomes analysis. However, its retrospective design limits the ability to establish causality, and the single-centre setting may restrict generalizability. Future prospective studies with more extensive, multi-centre cohorts must validate these findings and refine management protocols (12-14). This study highlights the significant impact of PROM duration on maternal and neonatal outcomes. Prolonged PROM (>24 hours) is associated with increased risks of chorioamnionitis, neonatal sepsis, and NICU admissions, emphasising the need for timely delivery (15). These findings support adopting proactive management strategies in terms of PROM to improve maternal and fetal health outcomes.

5. CONCLUSION

This retrospective study aimed to evaluate **maternal and neonatal outcomes in term PROM cases**. Our findings indicate that **prolonged PROM (>24 hours) is associated with increased maternal complications**, including **chorioamnionitis (7%), postpartum haemorrhage (5%), and endometritis (4%)**, emphasising the need for timely intervention. Neonatal outcomes also worsened with increasing PROM duration, with **higher rates of NICU admissions (16%), respiratory distress syndrome (8%), and neonatal sepsis (6%)**, notably when PROM exceeded 24 hours. The **Kaplan-Meier survival analysis** demonstrated a significant decline in neonatal health outcomes with extended PROM duration, supporting the need for **early labour induction in cases with delayed progression**. Our statistical analysis confirmed that **longer PROM duration is an independent predictor of poor neonatal outcomes**, with **a 5.2-fold increase in NICU admissions** and **a 4.7-fold higher risk of neonatal sepsis** in cases where PROM lasted more than 24 hours (**$p < 0.05$**). These findings highlight the **importance of early labour induction to reduce maternal and neonatal morbidity, particularly in cases without spontaneous labour** onset. From a clinical perspective, **individualised management strategies, infection prevention protocols (including timely administration of antibiotics), and close fetal monitoring** are crucial in optimising outcomes in term PROM cases. Future research should focus on refining **protocols for expectant management versus immediate induction**, particularly in settings with **limited resources or higher rates of infection-related complications**. By implementing **evidence-based guidelines**, healthcare providers can **minimise adverse outcomes and improve maternal and neonatal prognoses in PROM cases**.

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