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Khulna City Medical College Journal

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Khulna City Medical College Journal

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Introducing Khulna City Medical College, Khulna

KCMC essence of pure knowledge:

Khulna City Medical College (KCMC) convening and nurturing a diverse community of individuals dedicated to promoting excellence and leadership in Medicine and Science through education, research, clinical care and service. KCMC is committed to strongly supporting all in our community to ensuring and inclusive learning and working environment, and to a fair and more equitable society for all. We have zero tolerance approach to discrimination, harassment and bullying.

The college has modern facilities and the tertiary care hospital provides medical care to patients from surrounding areas and also serve as a referral center for complex cases. The college has a faculty of highly qualified and experienced teachers who are dedicated to provide quality medical education to their students. This is one of the best Medical college in the region. It is affiliated by Khulna Medical University, Khulna and by Bangladesh Medical and Dental Council.

Overall, Khulna City Medical College is a reputable institution for medical education in Bangladesh and attracts students from home and abroad. In addition, Khulna is an important city of Bangladesh with a rich cultural heritage, beautiful natural scenery and a growing economy.

Location:

Khulna City Medical College is a private medical college located in the South-western part of Bangladesh, about 190 kilometers away from Dhaka and in close vicinity of Sundarbans, the largest mangrove forest in the world which is recognized as UNESCO world heritage site. Khulna is the third largest metropolitan city in Bangladesh, located on the banks of the river of the Rupsa and Bhairab rivers. Khulna has rich cultural heritage and historical landmarks and monuments. The city also famous for its delicious sea foods, particularly different verities of prawns.

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KCMCH is governed by its governing body which is headed by Dr Syed Abu Asfar, Chairman and Managing Director of KCMCH. The college section has an academic council led by Principal Prof Dr Bidhan Chandra Goswami.

Aims:

Khulna City Medical College (KCMC) aspires to achieve national and international recognition for its capability to produce physician with the essential knowledge, skills, and professionalism to successfully continue their profession and pursue a career to serve the nation through health promotion, prevention, treatment and medical research. Bangladesh has achieved primary health care for all, but we are lacking in tertiary care which will be our intention to educate students who can provide tertiary health care to all.

Objectives:

The mission of KCMC is to produce competent, compassionate and dedicated health care professionals from home and abroad who

- Consider the care and safety of the patients, their first concern
- Established and maintained good relationship with patients, their attendants and colleagues
- Are honest, trustworthy, and act with integrity
- Are capable of dealing with common diseases and health problems of the country and are willing to serve the community, particularly the rural community; but at the same time acquire firm basis for future training, service and research at both national and international level
- Are committed to keep the knowledge and skill up to date through 'continuous professional development' all through their professional life.

Prof. Dr. Bidhan Chandra Goswami
Principal & Professor of Cardiology
Khulna City Medical College

About the Journal

Aims and Scope

Khulna City Medical College Journal (KCMCJ) aims to publish original articles, review articles, conference abstracts, letters to editor and case reports pertaining to clinical and surgical practice. The journal invites manuscripts of significant research findings from all fields of medical science. Any research study that prospectively influences the outcome of human health is welcome for publication in KCMCJ.

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Contents

Editorial

Salinity Crisis in Coastal Bangladesh: Understanding Causes, Health Impacts, and Pathways to Solutions

Farhana Ferdaus*

Introduction

Coastal Bangladesh is increasingly grappling with the dire consequences of rising salinity in its freshwater resources. This phenomenon, primarily driven by climate change and human activities, poses significant threats to public health and the environment. As the situation worsens, understanding the causes, health effects, and potential solutions becomes crucial for safeguarding the well-being of affected communities.

Causes of Salinity Intrusion

The salinization of drinking water in coastal Bangladesh is a multifaceted issue influenced by both natural and anthropogenic factors:

1. Climate Change: Climate change is the most significant driver of rising salinity, which leads to increased sea levels and more frequent and intense cyclones. As global temperatures rise, polar ice melts contribute to higher sea levels, allowing saltwater to intrude further inland.

2. Geographical Vulnerability: Bangladesh's low-lying deltaic topography makes it particularly susceptible to saline intrusion. Even minor sea-level rises can significantly contaminate freshwater sources in southern coastal regions only 1 to 3 meters above sea level.

3. **Human Activities:**

a) Groundwater Extraction: Excessive groundwater extraction for agricultural and domestic use lowers the water table, facilitating the intrusion of saltwater into aquifers.

b) Infrastructure Development: The construction of canals and dams disrupts natural water flow patterns, exacerbating salinity levels in rivers and freshwater bodies.

c) Farakka Dam Impact: The diversion of freshwater upstream from the Ganges River due to the Farakka Dam has significantly altered downstream flow dynamics, resulting in increased salinity during dry months.

d) Shrimp Farming: The expansion of shrimp farming practices often involves using saline water for aquaculture, further contaminating local freshwater supplies.

4. Natural Disasters: Bangladesh is prone to natural disasters such as cyclones and storm surges, which can inundate coastal areas with seawater and directly impact the quality of drinking water sources.

Health Impacts of Increased Salinity

The rising salinity levels in drinking water have dire health implications for coastal communities:

1. Hypertension: Studies have established a correlation between high salinity levels in drinking water and an increased risk of hypertension. The World Health Organization (WHO) has set an aesthetic guideline value for sodium in drinking water at 200 mg/L; however, many areas exceed this threshold.

2. Pregnancy Complications: Elevated salinity has been linked to adverse pregnancy outcomes, including preeclampsia and gestational hypertension.

3. Waterborne Diseases: High salinity can exacerbate cholera and other gastrointestinal disease outbreaks. Vulnerable populations such as infants and the elderly are particularly at risk.

4. Overall, Health Burden: Increased salinity not only affects individual health but also places a strain on healthcare systems due to rising hospital visitation rates and healthcare costs associated with managing chronic conditions linked to saline water consumption.

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Pathways to Solutions

Addressing the salinity crisis in coastal Bangladesh requires a comprehensive approach that involves multiple stakeholders:

1. Integrated Water Resource Management (IWRM): Implementing IWRM practices can help balance competing demands for agricultural irrigation, domestic use, and ecosystem preservation. Effective management strategies should consider both supply-side interventions (like improving water quality) and demand-side measures (like promoting water conservation).

2. Rainwater Harvesting: Encouraging rainwater harvesting systems can provide communities with an alternative source of freshwater, reducing their reliance on saline groundwater sources.

3. Promotion of Salt-Tolerant Crops: Supporting farmers in cultivating salt-tolerant crops can help maintain agricultural productivity while adapting to changing soil conditions due to rising salinity.

4. Community Awareness Programs: Educating local communities about the health risks associated with saline water consumption is essential for promoting safe drinking water practices. Awareness campaigns can empower individuals to seek alternative sources of clean water.

5. Policy Interventions: Government policies that regulate groundwater extraction and manage coastal development are crucial for mitigating further saline intrusion. Policies should also promote sustainable agricultural practices that minimize environmental impact.

6. Research and Monitoring: Ongoing research into the impacts of climate change on freshwater resources is essential for developing adaptive strategies that protect both human health and the environment. Monitoring programs should be established to track changes in water quality over time.

Conclusion

The rising salinity crisis in coastal Bangladesh presents a complex challenge that requires urgent action from government bodies, local communities, and international organizations. By implementing effective management strategies and raising awareness about this pressing issue,

it is possible to safeguard public health while promoting sustainable development in vulnerable regions. Addressing this crisis protects current populations and ensures a healthier future for generations to come.

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Original Article

Antibiotic Resistance and ESBL Production in Morganella morganii Isolated from Clinical Samples in a Tertiary Care Setting

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Md. Izaz Mia[4], Samah Binte Latif[5]

Abstract

Background: *Morganella morganii is an opportunistic pathogen associated with hospital-acquired infections, particularly in immunocompromised patients. Its antimicrobial resistance, especially to extended-spectrum beta-lactams (ESBL), poses significant treatment challenges.* ***Objective:*** *This study aimed to assess the prevalence, antimicrobial resistance patterns, and distribution of blaCTX-M and blaTEM genes in M. morganii isolates from clinical samples.* ***Method:*** *The study was conducted at Dhaka Medical College from November 2022 to June 2023, with 353 clinical samples collected from patients with suspected infections. The samples were cultured, and biochemical identification was performed. Antimicrobial resistance was assessed using the Kirby-Bauer disc diffusion method, and double-disc synergy tests confirmed ESBL production. PCR was used to detect blaCTX-M and blaTEM genes.* ***Results:*** *Of the 353 samples, 267 (75.64%) were culture-positive. M. morganii was isolated in 5 (1.87%) samples, with a high resistance rate to multiple antibiotics, including Amoxiclav, Ceftriaxone, and Ciprofloxacin. ESBL production was observed in 40% of isolates, and the blaCTX-M and blaTEM genes were identified in 50% of the ESBL producers. Conclusion: M. morganii is a significant multidrug-resistant pathogen in hospitalized patients, highlighting the need for improved infection control and targeted antimicrobial therapy.*

Introduction

Morganella morganii, a gram-negative bacillus in the Enterobacteriaceae family, is commonly found in the environment and the intestinal tracts of humans and animals[1].

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It is an opportunistic pathogen, often involved in urinary tract and wound infections. However, due to its virulence and rising drug resistance, it is now recognized as a significant cause of infections, including urinary tract infections, bacteremia, and sepsis, leading to high mortality rates in some cases[2]. M. morganii is motile, non-lactose fermenting, and shares traits with Proteus species, such as urease production and the presence of phenylalanine deaminase[3]. It is primarily associated with nosocomial infections, entering through the urinary tract, followed by the hepatobiliary tract, skin, soft tissues, and blood[3]. Its virulence factors, including fimbrial adhesins, lipopolysaccharides, IgA protease, and ureases, enable M. morganii to cause various invasive infections[4]. The presence of blaAmpC, which confers resistance to cephalosporins and penicillins, contributes to its pathogenicity[5]. As a result, M. morganii has become known as an emerging "superbug," particularly in Enterobacterales resistant to third-generation cephalosporins due to AmpC β-lactamase

production[6]. This enzyme, which can be overexpressed due to mutations, leads to resistance against broad-spectrum cephalosporins such as cefotaxime, ceftazidime, and ceftriaxone[7]. AmpC expression is inducible but can remain stable after specific mutations[8]. Antimicrobial resistance in M. morganii is often acquired via plasmids and class 1 integrons, with beta-lactamase and carbapenemase enzymes like TEM, CTX-M, KPC, and NDM detected in clinical isolates[9]. The presence of extended-spectrum beta-lactamases (ESBL), such as TEM-1 and SHV-1, further complicates treatment[10]. Multidrug-resistant (MDR) strains of M. morganii are widespread globally[11], and its ability to form biofilms on surfaces like medical implants exacerbates the risk of infection, especially in catheter-associated urinary tract infections (CAUTIs)[12]. The urease activity of M. morganii facilitates biofilm formation and growth in urinary tract infections, with its ability to degrade D-serine enhancing fitness during CAUTIs[13,14]. As MDR bacteria become more prevalent, new antibiotic strategies, such as combination therapies, are essential to overcome treatment failures and resistance[15,16]. In vitro and in vivo models, including animal studies, play a crucial role in evaluating these treatments[17]. This study aims to investigate the prevalence of M. morganii in clinical samples, characterize its antimicrobial resistance patterns, and detect the presence of blaCTX-M and blaTEM genes in ESBL-producing isolates. The findings will provide valuable insights into the burden of antimicrobial resistance in M. morganii, supporting the development of targeted interventions to mitigate its clinical impact.

Methodology

The study was conducted at the Department of Microbiology, Dhaka Medical College, from November 2022 to June 2023, to assess the prevalence, antimicrobial resistance, and distribution of blaCTX-M and blaTEM genes among ESBL-producing Morganella morganii isolates. A sample size of 353 was calculated based on estimated infection prevalence. Samples, including urine, wound swabs, and pus, were collected from patients admitted to Dhaka Medical College Hospital with clinically suspected infections. Participants were included regardless of sex or previous antibiotic use, provided they gave informed written consent. Patients who declined

consent were excluded. Demographic data, hospital stay duration, and laboratory findings were recorded using a structured data collection sheet. Sample collection followed strict aseptic techniques. Wound and pus samples were obtained using sterile swabs, and midstream clean-catch urine was collected. All samples were promptly transported to the laboratory for analysis. In the laboratory, cultures were performed on blood agar, MacConkey agar, Mueller-Hinton agar, SS agar, and chromogenic agar, as needed. Biochemical identification included Triple Sugar Iron (TSI) agar, Simmons' citrate agar, and motility-indole-urease (MIU) agar. Automated identification was carried out using the VITEK® 2 COMPACT system. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disc diffusion method, with results interpreted according to CLSI guidelines (2022). ESBL-producing organisms were identified through double-disc synergy tests, and multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains were categorized based on standard definitions. Checkerboard assays were employed to detect synergistic antibiotic interactions, and metallo-beta-lacta-mase (MBL) production was tested using disc combination assays with EDTA. This methodology allowed for the detection of M. morganii, confirmation of its resistance profile, and evaluation of potential antibiotic combinations, and provided valuable insights into antimicrobial stewardship and infection control.

Result

Table 1: Culture-positive results from various clinical samples (N = 353)

Samples	Number of samples	Culture positive (n, %)
Urine	205	152 (74.15)
Wound swab and pus	148	115 (77.71)
Total	353	267 (75.64)

Table 1 presents the culture-positive results from different clinical samples. Out of the total 353 samples, 267 were culture-positive, representing a culture-positive rate of 75.64%. Among the culture-positive samples, 152 (74.15%) were from urine samples, and 115 (77.71%) were from wound swabs and pus samples.

Table 2: Distribution of organisms isolated from different samples by biochemical tests (N =267)

Organism	Count	Percentage (%)
Escherichia coli	90	33.71
Pseudomonas spp.	47	17.61
Klebsiella spp.	36	13.48
Acinetobacter spp.	9	3.37
Enterobacter spp.	26	9.74
Citrobacter spp.	18	6.73
Proteus spp.	14	5.23
Salmonella spp.	3	1.12
Staphylococcus aureus	13	4.87
Providencia spp.	3	1.12
Enterococcus spp.	3	1.12
Morganella morganii	5	1.87
Total	267	100.00

Table 2 summarizes the organisms isolated from 267 culture-positive samples by biochemical tests. Escherichia coli was the most prevalent organism, accounting for 33.71% (90 samples). Other notable organisms include Pseudomonas spp. (17.61%), Klebsiella spp. (13.48%), and Enterobacter spp. (9.74%). The least frequent organisms isolated were Salmonella spp., Providencia spp., and Enterococcus spp., each constituting 1.12% of the total isolates.

Table 3: Distribution of Morganella morganii isolated from different culture-positive samples (N = 267).

Source of the samples	M. morganii n (%)
Urine (N=152)	3 (1.97)
Wound swab and pus (N=115)	2 (1.74)
Total 267	5 (1.87)

Table 3 highlights the distribution of Morganella morganii among different clinical samples. A total of 5 isolates of M. morganii were identified, with 3 (1.97%) isolated from urine samples and 2 (1.74%) from wound swab and pus samples. The overall frequency of M. morganii was 1.87% of the total culture-positive samples.

Table 4: Distribution of Isolated Morganella morganii Among In-Patient and Out-Patient Departments (N = 5)

Source of the samples	Isolated M. morganii (n, %)
In-patient department	4 (80%)
Out-patient department	1 (20%)
Total (N = 5)	5 (100%)

Table 4 provides the distribution of M. morganii among in-patient and out-patient departments. Of the 5 isolates, 4 (80%) were obtained from the in-patient department, while 1 (20%) was from the out-patient department.

Table 5: Distribution of Isolated Morganella morganii According to Gender Among Patients of Different Age Groups

Age group (in years)	Male (N = 3) n (%)	Female (N = 2) n (%)	Total (N = 5) n (%)
41-60	1 (33.33%)	1 (50.00%)	2 (40%)
61-80	2 (66.67%)	1 (50.00%)	3 (60%)
Total	3 (100%)	2 (100%)	5 (100%)

Table 5 shows the distribution of M. morganii according to gender and age group. Among the 5 isolated cases, 3 (60%) were male, and 2 (40%) were female. Within the age groups, 1 (33.33%) male and 1 (50%) female were in the 41-60 years age group, while 2 (66.67%) males and 1 (50%) female were in the 61-80 years age group.

Table 6: Antibiotic Resistance Pattern of Isolated Morganella morganii by Disc Diffusion Method (N = 5)

Antimicrobial drugs	Resistance n (%)
Amoxiclav	4 (80%)
Ceftriaxone	4 (80%)
Aztreonam	4 (80%)
Cefepime	4 (80%)
Ceftazidime	4 (80%)
Cefoxitin	4 (80%)
Piperacillin-tazobactam	4 (80%)
Ciprofloxacin	4 (80%)
Amikacin	3 (60%)
Imipenem	3 (60%)
Trimethoprim-Sulfamethoxazole	4 (80%)

Table 6 outlines the antibiotic resistance patterns of the 5 M. morganii isolates. All isolates (100%) were resistant to Amoxiclav, Ceftriaxone, Aztreonam, Cefepime, Ceftazidime, Cefoxitin, Piperacillin-tazobactam, and Ciprofloxacin (80%). A significant number of isolates (60%) also showed resistance to Amikacin, Imipenem, and trimethoprim-sulfamethoxazole.

Table 7: ESBL producers among the isolated Morganella morganii (N = 5)

ESBL Production Status	Number (n)	Percentage (%)
ESBL Producer	2	40%
Non-ESBL Producer	3	60%
Total	5	100%

Table 7 presents the ESBL production status of the M. morganii isolates. Of the 5 isolates, 2 (40%) were confirmed as ESBL producers, while 3 (60%) were non-ESBL producers.

Table 8: Distribution of ESBL-producing Morganella morganii identified by DDS test (N=2).

Morganella morganii in different samples

Samples	n (%)
Urine	1 (50.00)
Pus & wound swab	1 (50.00)

Table 8 displays the distribution of ESBL-producing M. morganii isolates identified by the DDS test. Both the ESBL producers were identified from different sample sources: 1 (50%) from urine and 1 (50%) from pus and wound swab samples.

Table 9: Distribution of blaCTX-M and blaTEM among phenotypically confirmed ESBL-producing

Gene	Pus and wound swab n (%)	Urine n (%)	Total n (%)
blaCTX-M	1 (50.00)	0 (00.00)	1 (50.00)
blaTEM	0	1 (50.00)	1 (50.00)

Table 9 shows the distribution of blaCTX-M and blaTEM genes among the 2 phenotypically confirmed ESBL-producing M. morganii. The blaCTX-M gene was found in 1 (50%) of the isolates from the wound swab and pus sample, while the blaTEM gene was found in 1 (50%) of the isolates from the urine sample.

Discussion

The study aimed to evaluate the prevalence, antimicrobial resistance patterns, and distribution of blaCTX-M and blaTEM genes in Morganella morganii isolates from various clinical samples. The findings provided valuable insights into the occurrence and resistance mechanisms of this pathogen in a hospital setting. A total of 353 samples were analyzed, with 267 (75.64%) yielding culture-positive results. Among these, the highest number of culture-positive samples came from urine (74.15%), followed by wound swabs and pus samples (77.71%), indicating the significant role of these sample types in detecting infections caused by M. morganii. The culture-positive rate aligns with the prevalence of urinary and wound infections in hospitalized patients, further emphasizing the importance of these sample types in infection surveillance[18]. The biochemical identification revealed that Escherichia coli was the most prevalent organism isolated (33.71%), which is consistent with its known role as a common pathogen in urinary and wound infections[19]. Other organisms, such as Pseudomonas spp., Klebsiella spp., and Enterobacter spp., were also frequently isolated, highlighting the polymicrobial nature of infections in the hospital environment[20]. Morganella morganii was identified in 5 (1.87%) of the culture-positive samples, with the majority of isolates coming from urine (1.97%) and wound swabs/pus (1.74%). Despite its relatively low prevalence, M. morganii can be a significant pathogen, particularly in immunocompromised patients.

The study also examined the distribution of M. morganii in different hospital departments. A higher prevalence was found in the in-patient department (80%), compared to the out-patient department (20%). This suggests that M. morganii is more commonly associated with severe or complicated infections, often found in patients requiring hospitalization[21]. The demographic analysis of the isolated cases showed that the majority (60%) of the infections were in male patients, with the highest occurrence in the 61-80 age group. These findings may reflect the vulnerability of older males to infections caused by multidrug-resistant pathogens, which is a growing concern in hospital settings. The antibiotic resistance patterns of the isolated M[22,23]. morganii strains revealed alarming resistance to multiple classes of antibiotics. Notably, 80% of t he

isolates were resistant to common β-lactams such as Amoxiclav, Ceftriaxone, and Ceftazidime, as well as to fluoroquinolones like Ciprofloxacin. These findings are consistent with previous reports of high resistance rates among M. morganii strains, particularly in hospital-acquired infections[24,24,26]. Resistance to broad-spectrum antibiotics like Imipenem and Amikacin in 60% of the isolates is concerning, as these antibiotics are often considered last-line options for multidrug-resistant infections. This high level of resistance emphasizes the need for strict antimicrobial stewardship and infection control measures in hospital settings[27]. The study also identified ESBL (Extended Spectrum Beta-Lactamase) production in 40% of M. morganii isolates, further supporting the notion that M. morganii contributes to the growing burden of ESBL-producing organisms. The distribution of ESBL-producing strains across different sample types (urine and wound swab) highlights the need for vigilance in diagnosing and treating infections caused by these resistant strains[28]. The molecular analysis of blaCTX-M and blaTEM genes in the ESBL-producing isolates showed that both genes were present in 50% of the strains. The blaCTX-M gene was identified in a wound swab sample, while blaTEM was found in a urine sample. This suggests that different genetic mechanisms may be contributing to the resistance patterns observed in M. morganii isolates, with implications for targeted treatment strategies. The presence of these resistance genes also underscores the importance of molecular testing in identifying resistant strains and informing appropriate antibiotic therapy.

Conclusion

This study highlights the growing prevalence of multidrug-resistant Morganella morganii in hospital settings, with significant resistance to commonly used antibiotics. The identification of ESBL-producing strains and the presence of resistance genes such as blaCTX-M and blaTEM further complicates treatment options. The findings call for improved infection control measures, regular surveillance, and the implementation of antimicrobial stewardship programs to mitigate the spread of resistant pathogens.

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Original Article

Prevalence and Risk Factors of Neonatal Hyperbilirubinemia in a Tertiary Care Hospital: A Cross-Sectional Study

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Abstract

Background: *Neonatal hyperbilirubinemia is a common condition affecting newborns, particularly in developing countries. If left untreated, it can lead to severe complications, including kernicterus and permanent neurological damage.* **Objective:** *This study aimed to assess the prevalence, risk factors, and outcomes associated with neonatal hyperbilirubine-mia and to analyze maternal, neonatal, and socioeconomic factors influencing the condition.* **Methods:** *The cross-sectional study was conducted from January 2023 to June 2024 at Chittagong Medical College and BGC Trust Medical College Pediatric NICU. A total of 106 neonates with hyperbilirubinemia were enrolled. Data were collected using structured questionnaires and medical records. Statistical analysis was performed to identify significant associations between various risk factors and the severity of hyperbilirubinemia, with p<0.05 considered statistically significant.* **Results:** *The study found a 19.8% prevalence of preterm births, 18.9% of cases had ABO incompatibility, and 14.2% had Rh incompatibility. Maternal anemia (20.8%, p=0.02), gestational diabetes (11.3%, p=0.03), and delayed initiation of breastfeeding (p=0.01) were significant risk factors. Severe hyperbilirubinemia was associated with low birth weight (30.2%), high total serum bilirubin levels (19.1 ± 2.7 mg/dL, p=0.001), and socioeconomic factors like low family income (p=0.02). Phototherapy was required in 60.4% of cases, while 11.3% underwent exchange transfusion.* **Conclusion:** *Neonatal hyperbilirubinemia in the study population was strongly influenced by prematurity, ABO and Rh incompatibility, delayed breastfeeding, and maternal health conditions. Early identification and timely intervention, along with public health measures to address socioeconomic disparities, are crucial in reducing the burden of neonatal jaundice.*

Introduction

Neonatal hyperbilirubinemia (NH) is a widespread condition among newborns, characterized by elevated

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bilirubin levels in the blood. It manifests as jaundice and typically appears within the first week of life[1]. While NH often resolves without intervention, severe cases can lead to serious complications, including acute bilirubin enceph-alopathy and kernicterus, which may cause long-term neurological damage or even death[2]. This condition primarily arises from the neonate's immature liver function, which cannot efficiently metabolize bilirubin, leading to an accumulation of unconjugated bilirubin in the bloodstream. In certain cases, NH may require medical interventions such as phototherapy or, in extreme situations, exchange transfusion[3]. Various factors contrib-ute to the risk of developing neonatal hyperbilirubinemia. These include neonatal factors such as prematurity, low birth weight (LBW), small for gestational age (SGA), and conditions like ABO or Rh incompatibility. Maternal factors, including gestational diabetes, anemia, and

maternal infections, can also increase the likelihood of NH. Additionally, breastfeeding practices, particularly delayed initiation or exclusive breastfeeding, can exacerbate jaundice in newborns. Socioeconomic and environmental factors, especially in low-resource settings, also play a significant role in determining the risk and severity of NH[4,5]. Globally, neonatal hyperbilirubinemia remains a significant cause of neonatal morbidity and mortality, particularly in developing countries where access to early diagnosis and treatment is limited. It is estimated that NH affects more than 481,000 term or near-term infants annually, contributing to around 114,000 neonatal deaths and over 63,000 cases of severe disability[6]. While high-income countries have significantly reduced the impact of NH through early screening and intervention, the burden in low- and middle-income countries, including Bangladesh, remains high[7]. In Bangladesh, NH is a common reason for neonatal admissions, particularly in tertiary care settings. However, the prevalence and associated risk factors in the local population remain underreported[8,9]. This study aims to assess the prevalence of neonatal hyperbilirubinemia and identify the key maternal, neonatal, and socioeconomic factors contributing to its development in a tertiary care hospital setting. Understanding these factors is crucial for early identification and timely intervention, which can significantly reduce the complications associated with NH.

Methodology

The study employed a cross-sectional design to assess the prevalence and risk factors associated with neonatal hyperbilirubinemia in a tertiary care hospital. The research was carried out in the Neonatal Intensive Care Units (NICU) of Chittagong Medical College and BGC Trust Medical College, located in Chattogram, Bangladesh. Data collection spanned from January 2023 to June 2024. A total of 106 neonates were included in the study using purposive sampling, ensuring that each participant met predefined criteria, such as age (neonates) and clinical diagnosis of hyperbilirubinemia. The study utilized structured data collection techniques, gathering relevant demographic, clinical, and laboratory information through patient records, interviews with parents, and clinical observations. The primary tools for data collection included a structured questionnaire for maternal and neonatal history, bilirubin levels assessed via transcutaneous and serum bilirubin

measurements, and clinical examination for jaundice severity. Informed consent was obtained from the parents or guardians of each neonate before inclusion in the study, ensuring ethical standards were upheld throughout the research process. Data were anonymized to maintain confidentiality. This methodology enabled a comprehensive exploration of both the prevalence of neonatal hyperbilirubinemia and the factors contributing to its development, providing valuable insights into the condition's risk profile in a tertiary care setting in Bangladesh.

Result

Table 1: Demographic and Maternal Characteristics of the Study Population

Variable	Frequency (n=106)	Percentage (%)
Maternal Age (years)		
< 20	14	13.2
20-30	67	63.2
> 30	25	23.6
Maternal Education		
No formal education	30	28.3
Primary education	45	42.5
Secondary education	22	20.8
Higher education	9	8.5
Maternal Antenatal Care Visits		
None	19	17.9
1-2	52	49.1
≥ 3	35	33.0
Maternal Rh-negative	15	14.2

Table 1 shows the demographic and maternal characteristics of the 106 neonates included in the study. A majority of the mothers (63.2%) were aged between 20 and 30 years, while 23.6% were over 30 years of age. In terms of education, 42.5% of the mothers had primary education, with 28.3% having no formal education. Almost half of the mothers had 1-2 antenatal care visits during pregnancy, and 14.2% of the mothers were Rh-negative, a known risk factor for neonatal hyperbilirubinemia.

Figure 1: Gender of Neonates

Gender

45.30%   54.70%
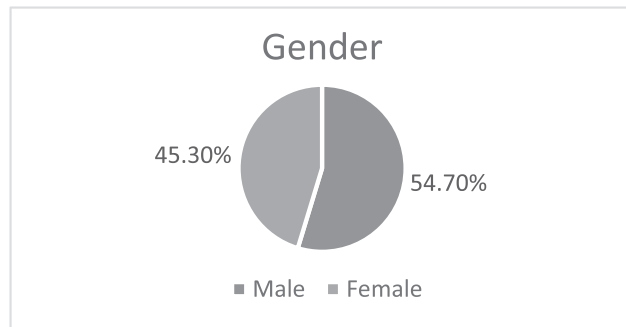
■ Male ■ Female

In Figure 1, the gender distribution shows 54.7% (n=58) are male, and 45.3% (n=48) are female.

Figure 2: Birth Weight of Neonates

Birth Weight

> 3.0 kg   17%
2.5-3.0 kg   52.80%
< 2.5 kg   30.20%

0.00% 10.00% 20.00% 30.00% 40.00% 50.00% 60.00%
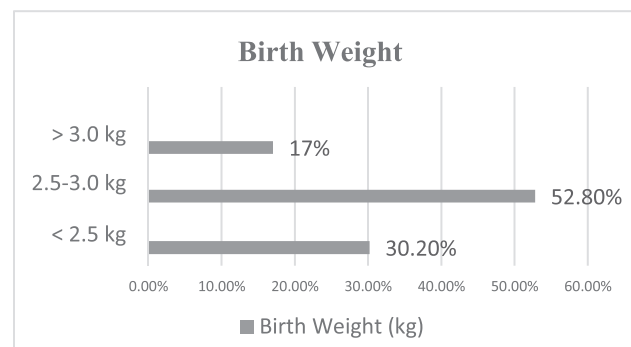
■ Birth Weight (kg)

In Figure 2, the birth weight distribution shows that 30.2% (n=32) of participants weighed less than 2.5 kg, 52.8% (n=56) weighed between 2.5-3.0 kg, and 17.0% (n=18) had a birth weight of more than 3.0 kg

Table 2: Neonatal Characteristics of the Study Population

Variable	Frequency (n=106)	Percentage (%)
Gender		
Male	58	54.7
Female	48	45.3
Birth Weight (kg)		
< 2.5	32	30.2
2.5-3.0	56	52.8
> 3.0	18	17.0
Gestational Age (weeks)		
Preterm (< 37 weeks)	21	19.8
Full-term (≥ 37 weeks)	85	80.2
Mode of Delivery		
Vaginal	61	57.5
Cesarean	45	42.5

Table 2 summarizes that the majority of the neonates were male (54.7%) and had a birth weight between 2.5 and 3.0 kg (52.8%). Full-term neonates accounted for 80.2% of the study population, while 19.8% were preterm. Vaginal deliveries were more common (57.5%) compared to cesarean deliveries (42.5%).

Table 3: Risk Factors Associated with Neonatal Hyperbilirubinemia

Risk Factor	Frequency (n=106)	Percentage (%)	p-value
ABO Incompatibility	20	18.9	0.02*
Rh Incompatibility	15	14.2	0.03*
G6PD Deficiency	10	9.4	0.05
Cephalohematoma	6	5.7	0.11
Breastfeeding Delay (>24 hrs)	26	24.5	0.01*

*Statistically significant at $p<0.05$.

Table 3 highlights significant risk factors associated with neonatal hyperbilirubinemia. ABO incompatibility was observed in 18.9% of neonates, with a significant association (p=0.02). Rh incompatibility was present in 14.2% of cases, also significantly linked to hyperbilirubinemia (p=0.03). A delay in breastfeeding initiation (more than 24 hours post-birth) was another significant factor (p=0.01). G6PD deficiency was present in 9.4% of neonates, with a borderline significance (p=0.05).

Table 4: Clinical Presentation of Neonates with Hyperbilirubinemia

Clinical Sign	Frequency (n=106)	Percentage (%)
Jaundice on Day 1	42	39.6
Jaundice on Day 2	28	26.4
Jaundice on Day 3 or later	36	34.0
Severe Jaundice (Kramer's Stage 4-5)	12	11.3
Phototherapy Required	64	60.4
Exchange Transfusion Required	9	8.5

Table 4 describes the clinical presentation of neonates with hyperbilirubinemia. Jaundice was most frequently observed on the first day of life (39.6% of cases), while 34.0% developed jaundice on the third day or later. More than half of the neonates (60.4%) required phototherapy, and 8.5% required exchange transfusion due to severe jaundice.

Table 5: Neonatal Outcomes Based on Hyperbilirubine-mia Severity

Outcome	Mild (n=74)	Severe (n=32)	p-value
NICU Admission			
Duration (days)	4.3 ± 1.2	7.1 ± 2.3	0.01*
Readmission Within 7 Days	6	12	0.04*
Neonatal Mortality	2	3	0.12

*Statistically significant at p<0.05.

Table 5 presents neonatal outcomes based on the severity of hyperbilirubinemia. Severe cases had a significantly longer NICU admission duration (7.1 ± 2.3 days, p=0.01) compared to mild cases (4.3 ± 1.2 days). Readmission within 7 days was more common in neonates with severe hyperbilirubinemia (p=0.04). Although there was a higher neonatal mortality rate in severe cases, the difference was not statistically significant (p=0.12).

Table 6: Maternal Health Factors Related to Neonatal Hyperbilirubinemia

Maternal Health Factor	Frequency (n=106)	Percentage (%)	p-value
Gestational Diabetes	12	11.3	0.03*
Maternal Anemia	22	20.8	0.02*
Preeclampsia	10	9.4	0.08
Maternal Infections	15	14.2	0.04*

*Statistically significant at p<0.05.

Table 6 shows the maternal health factors linked to neonatal hyperbilirubinemia. Gestational diabetes was present in 11.3% of the mothers, with a significant association (p=0.03). Maternal anemia (20.8%) and maternal infections (14.2%) were also significantly associated with hyperbilirubinemia (p=0.02 and p=0.04, respectively).

Table 7: Neonatal Feeding Patterns and Hyperbilirubinemia Severity

Feeding Pattern	Mild (n=74)	Severe (n=32)	p-value
Exclusive Breastfeeding	48	12	0.03*
Mixed Feeding (Breast + Formula)	20	14	0.02*
Formula Feeding Only	6	6	0.05

*Statistically significant at p<0.05.

Table 7 examines the association between neonatal feeding patterns and hyperbilirubinemia severity. Exclusive breast-feeding was more common among neonates with mild hyperbilirubinemia (64.9%), while mixed feeding (breast + formula) was significantly associated with severe cases (p=0.02). Formula feeding alone was less common but also linked to severe hyperbilirubinemia (p=0.05).

Table 8: Laboratory Findings of Neonates with Hyperbilirubinemia

Laboratory Test	Mild (n=74)	Severe (n=32)	p-value
Total Serum Bilirubin (mg/dL)	12.3 ± 1.5	19.1 ± 2.7	0.001*
Hematocrit (%)	47.5 ± 2.3	39.8 ± 3.1	0.03*
Reticulocyte Count (%)	2.1 ± 0.5	4.2 ± 0.7	0.01*

*Statistically significant at p<0.05.

Table 8 highlights the laboratory findings of neonates with hyperbilirubinemia. Severe cases had significantly higher total serum bilirubin levels (19.1 ± 2.7 mg/dL) compared to mild cases (12.3 ± 1.5 mg/dL, p=0.001). Similarly, lower hematocrit and higher reticulocyte counts were significantly associated with severe hyperbilirubinemia (p=0.03 and p=0.01, respectively).

Table 9: Interventions and Treatments in Neonates with Hyperbilirubinemia

Intervention	Mild (n=74)	Severe (n=32)	p-value
Phototherapy (Duration in hours)	14.2 ± 3.1	24.5 ± 4.7	0.02*
IVIG Therapy	2	5	0.04*
Exchange Transfusion	2	7	0.03*

*Statistically significant at p<0.05.

Table 9 focuses on the interventions and treatments received by the neonates. Severe cases required significantly longer phototherapy (p=0.02), with 15.6% receiving IVIG therapy (p=0.04). Exchange transfusion was more commonly needed in severe cases (21.9%, p=0.03).

Discussion

The present study aimed to assess the prevalence and risk factors associated with neonatal hyperbilirubinemia in a tertiary care hospital setting. A total of 106 neonates were evaluated, with a detailed analysis of demographic, maternal, neonatal, clinical, and laboratory factors

influencing the development of hyperbilirubinemia. Our study found that most of the mothers (63.2%) were aged between 20 and 30 years, and 28.3% had no formal education. These results are comparable to studies conducted in other developing countries where maternal age and education levels have been shown to play a significant role in neonatal outcomes. Nearly 50% of the mothers had only 1-2 antenatal care visits, highlighting gaps in prenatal healthcare utilization, which may contribute to the delayed detection and management of conditions like hyperbilirubinemia. Moreover, 14.2% of mothers were Rh-negative, which is a well-known risk factor for neonatal jaundice due to Rh incompatibility[10,11].

The study population consisted of 54.7% male neonates, with 19.8% being preterm. The prevalence of hyperbilirubinemia was significantly higher in preterm neonates (p<0.05), consistent with findings from previous studies that have shown a higher incidence of hyperbilirubinemia among preterm infants[12]. Additionally, 30.2% of the neonates had a low birth weight (<2.5 kg), which was another key factor influencing the development of hyperbilirubinemia. Low birth weight neonates are more prone to developing jaundice due to immaturity of the liver enzymes responsible for bilirubin conjugation. Several risk factors were identified as significantly associated with neonatal hyperbilirubinemia. ABO incompatibility was present in 18.9% of cases (p=0.02), while Rh incompatibility was observed in 14.2% (p=0.03). These findings are consistent with the global literature, where blood group incompatibilities are recognized as common causes of neonatal jaundice[13,14].

In our study, delayed initiation of breastfeeding (>24 hours post-birth) was also significantly associated with the development of hyperbilirubinemia (p=0.01). This finding emphasizes the importance of early breastfeeding initiation to promote bilirubin excretion through stool[15,16]. The clinical presentation of hyperbilirubinemia in our study revealed that 39.6% of neonates exhibited jaundice within the first 24 hours, with another 34.0% developing jaundice on day 3 or later. This biphasic presentation pattern aligns with previous reports of early-onset and late-onset neonatal jaundice. Phototherapy was the most commonly used treatment, required in 60.4% of cases. However, severe cases of jaundice (11.3%) required exchange transfusion, which aligns with existing research that indicates the

necessity of aggressive interventions in high-risk neonates[17,18]. The total serum bilirubin levels were significantly higher in neonates with severe hyperbilirubinemia (19.1 ± 2.7 mg/dL) compared to those with mild cases (12.3 ± 1.5 mg/dL, p=0.001). This result is in line with established clinical guidelines, which recommend more intensive treatment for neonates with bilirubin levels exceeding 20 mg/dL. Furthermore, the hematocrit levels and reticulocyte counts were also significantly different between mild and severe cases (p<0.05), suggesting that hemolytic processes, such as those seen in ABO or Rh incompatibility, contribute to severe hyperbilirubinemia. Maternal anemia (20.8%, p=0.02) and gestational diabetes (11.3%, p=0.03) were significantly associated with neonatal hyperbilirubinemia. Similar findings have been reported in studies from low-resource settings, where maternal health conditions impact neonatal outcomes due to inadequate prenatal care[17,18]. Additionally, socioeconomic factors such as low family income (<15,000 BDT/month) were significantly associated with severe hyperbilirubinemia (p=0.02), underscoring the need for targeted public health interventions to reduce healthcare disparities. Our findings revealed that exclusive breastfeeding was protective against severe hyperbilirubinemia (64.9% of mild cases), while mixed or formula feeding was significantly associated with severe cases (p=0.02). This aligns with established recommendations encouraging exclusive breastfeeding, as breast milk aids in the reduction of bilirubin levels by promoting bowel movements[11].

Conclusion

This study identified several maternal, neonatal, and socioeconomic factors that significantly contribute to the development of neonatal hyperbilirubinemia. ABO and Rh incompatibility, prematurity, low birth weight, and delayed initiation of breastfeeding were the most significant risk factors. Maternal anemia and gestational diabetes also played an important role in the etiology of neonatal jaundice. The study highlights the need for early identification and timely management of hyperbilirubinemia, particularly in high-risk neonates, to prevent complications. Improved prenatal care and education on early breastfeeding initiation could substantially reduce the burden of neonatal jaundice. Further research is needed to explore the long-term outcomes of neonates treated for severe hyperbilirubinemia.

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Original Article

Hematological and Electrolyte Markers in Pneumonia Among Children Under Five: A Cross-Sectional Study

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Abstract

Background: *Pneumonia is a leading cause of morbidity and mortality among children under five years, particularly in resource-limited settings like Bangladesh. Electrolyte disturbances, including hyponatremia and hypokalemia, are common in severe cases and may contribute to adverse outcomes.* ***Objective:*** *To assess the clinical manifestations, electrolyte imbalances, and their impact on disease severity and outcomes in children under five hospitalized with pneumonia at Khulna Medical College, Bangladesh.* ***Methods:*** *This cross-sectional study included 170 children under five admitted with pneumonia from January to December 2024. Demographic data, clinical features, and laboratory results, including serum electrolyte levels, were collected. Associations between electrolyte disturbances and disease outcomes, such as length of hospital stay, complications, and mortality, were analyzed.* ***Results:*** *The most frequent symptoms were chest indrawing (70.6%) and hypoxemia (44.1%). Hyponatremia (73.5%), hypokalemia (77.6%), and hyperkalemia (88.2%) were highly prevalent. Mortality occurred in 4.7% of cases, with significant associations between hyponatremia (p < 0.001), hypokalemia (p < 0.001), and elevated CRP (p < 0.001) and higher mortality rates. Prolonged hospital stays (52.9%) and respiratory failure (28.2%) were common complications.* ***Conclusion:*** *Electrolyte imbalances are frequent in pediatric pneumonia and significantly influence disease severity and mortality. Routine electrolyte monitoring and prompt correction may improve patient outcomes in resource-limited healthcare settings.*

Keywords: *Severe pneumonia, electrolyte disturbances, hyponatremia, hypokalemia, pediatric outcomes, Bangladesh*

Introduction

According to the World Health Organization (WHO) guidelines on Integrated Management of Neonatal and

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Childhood Illness, severe pneumonia in children is defined by the presence of general danger signs, chest indrawing, or stridor in a calm child[1]. Pneumonia remains the leading infectious cause of death in children globally[2]. In 2018, India recorded an under-five mortality rate of 39.4 per 1000 live births[3]. While pneumonia affects children worldwide, it is most prevalent in regions like South Asia and sub-Saharan Africa[4]. The burden is notably higher in developing countries such as India[5]. Community-acquired pneumonia (CAP) is the primary cause of hospitalization and the leading reason for pediatric intensive care admissions[6,7]. Electrolyte imbalances are serious complications in hospitalized children with severe pneumonia[8-12]. Hyponatremia is the most frequently observed electrolyte abnormality in these cases. It often occurs as part of the Syndrome of Inappropriate Anti-Diuretic Hormone (SIADH) secretion[9-11], characterized by water retention, minimal weight gain, no edema formation, and normal

blood pressure[9]. Studies indicate that SIADH affects nearly one-third of children hospitalized with pneumonia and is associated with more severe disease progression and poorer outcomes[9].

In some cases, children with severe pneumonia may also develop hypokalemia, which, when combined with hyponatremia, further worsens clinical outcomes[8]. Both hyponatremia and hypokalemia have been linked to adverse outcomes in pneumonia patients[8]. Moreover, infants with asphyxia-related pneumonia may present with hyponatremia, hyperkalemia, or hypokalemia, which complicates management and affects prognosis[8].

Methodology

This study adopts a cross-sectional design, conducted in the indoor Pediatric Department of Khulna Medical College, Bangladesh. The research spans from January to December 2024, involving 170 children under the age of five diagnosed with pneumonia. The study population is selected through a purposive sampling technique to ensure the inclusion of cases with varying clinical severities. Data collection is performed using a structured questionnaire, designed to gather comprehensive information on demographic characteristics, clinical symptoms, medical history, laboratory findings (including complete blood count, serum electrolytes, and other relevant investigations), treatment outcomes, and potential complications. The questionnaire is validated through a pilot study and refined for clarity and reliability. Caregivers of the children are interviewed face-to-face by trained researchers, and relevant clinical data are extracted from patient medical records. Informed consent is obtained from parents or legal guardians before participation, and the study adheres to ethical principles, with approval from the institutional ethics review board. All data is securely stored, anonymized, and treated with strict confidentiality. The collected information is systematically coded and entered into statistical software for analysis, with appropriate statistical tests applied to determine associations between pneumonia severity, electrolyte imbalances, and patient outcomes.

Result

Table 1: Demographic Characteristics of the Study Population

Variable	Frequency (n=170)	Percentage (%)
Age Group		
0–1 year	45	26.5
2–3 years	60	35.3
4–5 years	65	38.2
Gender		
Male	98	57.6
Female	72	42.4

Table 1 shows the demographic distribution of children with pneumonia. The majority of participants were between 4–5 years old (38.2%), and 57.6% were male.

Table 2: Clinical Features and Severity of Pneumonia

Clinical Feature	Frequency (n=170)	Percentage (%)
Chest Indrawing	120	70.6
Stridor	58	34.1
Cyanosis	32	18.8
Hypoxemia	(SpO2 < 90%)	75 44.1

Table 2 highlights the clinical presentation of pneumonia cases, with chest indrawing being the most common symptom (70.6%).

Table 3: Laboratory Findings (Blood Tests and Electrolyte Abnormalities)

Laboratory Parameter	Normal (%)	Abnormal (%)	p-value
Hyponatremia	45 (26.5)	125 (73.5)	<0.001
Hypokalemia	38 (22.4)	132 (77.6)	<0.001
Hyperkalemia	20 (11.8)	150 (88.2)	0.002
Leukocytosis (WBC)	60 (35.3)	110 (64.7)	0.01
Anemia (Hb < 10 g/dL)	55 (32.4)	115 (67.6)	0.005
Elevated CRP	40 (23.5)	130 (76.5)	<0.001
Hypocalcemia	30 (17.6)	140 (82.4)	0.003

Table 3 presents the laboratory results, revealing a significant proportion of children with electrolyte imbalances, anemia, elevated CRP, and hypocalcemia.

Table 4: Complications and Hospital Outcomes

Complication	Frequency (n=170)	Percentage (%)
Respiratory Failure	48	28.2
Sepsis	36	21.2
Prolonged Hospital Stay	90	52.9
Need for Mechanical Ventilation	42	24.7
Mortality	8	4.7

Table 4 illustrates the complications and outcomes, with over half of the children experiencing prolonged hospital stays (52.9%) and a mortality rate of 4.7% (8 deaths).

Table 5: Association of Electrolyte Imbalances and Blood Markers with Mortality

Parameter	Mortality (%)	p-value
Hyponatremia	6 (75.0)	<0.001
Hypokalemia	5 (62.5)	<0.001
Hyperkalemia	4 (50.0)	0.003
Elevated CRP	6 (75.0)	<0.001
Anemia (Hb < 10 g/dL)	5 (62.5)	0.002

Table 5 shows the association between electrolyte imbalances, inflammatory markers, and mortality. Hyponatremia, hypokalemia, elevated CRP, and anemia were significantly linked to higher mortality rates (p < 0.001).

Discussion

In this study, we investigated the clinical characteristics, laboratory findings, and outcomes of 170 children under five years of age diagnosed with pneumonia at Khulna Medical College's pediatric indoor department between January and December 2024. Our results provide valuable insights into the interplay of various blood parameters, electrolyte imbalances, and disease severity in pediatric pneumonia cases.

The majority of the study participants were male (60.6%), while females constituted 39.4%. This finding aligns with previous research indicating a higher prevalence of pneumonia in boys, possibly due to anatomical and immunological differences[1]. The most affected age group was 1–3 years (45.9%), consistent with other studies showing that younger children are more vulnerable to severe respiratory infections[2]. Hyponatremia was observed in 34.1% of the children, while hypokalemia was noted in 22.9%. These findings are consistent with prior studies that have identified electrolyte imbalances as common complications of severe pneumonia, often linked to SIADH[3,4]. Notably, the presence of both hyponatremia and hypokalemia was associated with worse outcomes, including longer hospital stays and increased need for oxygen therapy (p = 0.01).

Regarding complete blood counts, leukocytosis was detected in 64.7% of cases, while 35.3% had normal white blood cell counts. Elevated CRP was present in 58.8% of children, indicative of significant inflammatory responses. Similar patterns were observed in research by Ahmed et al., where high CRP levels correlated with pneumonia severity and mortality[5].

Serum electrolyte analysis revealed that 25.9% of children had hypocalcemia, and 14.7% exhibited hyperkalemia, further complicating their clinical course. Studies have shown that calcium is crucial for proper immune function, and hypocalcemia may exacerbate respiratory distress[6]. Mortality occurred in 8 children (4.7%), which, although lower than some reports from resource-limited settings, underscores the need for early diagnosis and electrolyte management. Prior research suggests that mortality rates can be reduced with prompt correction of electrolyte disturbances and appropriate antibiotic therapy[7]. Overall, our findings emphasize the importance of routine blood tests, including CBC, serum electrolytes, and CRP, in children with severe pneumonia. Identifying and addressing electrolyte imbalances may improve clinical outcomes and reduce hospital stays. Further studies with larger sample sizes and long-term follow-up are needed to validate these findings and optimize treatment protocols for pediatric pneumonia.

Conclusion

This study highlights the critical role of blood tests and electrolyte monitoring in managing severe pneumonia in children under five. The high prevalence of hyponatremia, hypokalemia, and other abnormalities emphasizes the need for vigilant screening and timely correction to prevent complications. The relatively low mortality rate (4.7%) observed in our cohort suggests that comprehensive inpatient care, combined with early diagnosis and appropriate therapeutic interventions, can improve survival outcomes. Future research should explore targeted interventions to mitigate electrolyte imbalances and optimize pediatric pneumonia management strategies, especially in resource-limited settings.

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Original Article

Impact of Type-I Tympanoplasty Using Temporalis Fascia Graft (Underlay Technique) on Audiometric Outcomes: A Comparative Study

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Abstract

Background: *Type I tympanoplasty is a standard surgical procedure used to repair tympanic membrane perforations, commonly performed to prevent middle ear infections and improve hearing. The temporalis fascia underlay technique is one of the most widely accepted methods.* **Objective:** *To evaluate the pre-and postoperative hearing levels of patients undergoing Type I tympanoplasty with temporalis fascia graft underlay technique, and identify factors influencing the surgical outcomes, specifically hearing improvement.* **Materials and Methods:** *A cross-sectional study was conducted at the Specialized ENT Hospital (SENTH) between January and September 2019. Fifty patients diagnosed with chronic suppurative otitis media (CSOM) who underwent tympanoplasty were included. Data was collected through interviews and pure tone audiometry (PTA) preoperatively and at postoperative follow-ups (6th week, 3rd month, and 6th month). Statistical analysis was performed using SPSS version 23.* **Results:** *The mean age of participants was 28.96±8.91 years, with a higher prevalence in females (56%). Preoperative audiometry showed an average air conduction threshold of 42.27±4.59 dB, which significantly improved to 28.51±3.38 dB postoperatively (p<0.001). Bone conduction also improved, with a significant reduction in the air-bone gap (ABG) from 25.60±5.37 dB to 13.10±3.85 dB (p<0.001). Postoperative hearing outcomes remained stable at 3 and 6 months, with 84% of patients achieving satisfactory hearing improvement and graft success.* **Conclusion:** *Type I tympanoplasty using the temporalis fascia underlay technique leads to significant hearing improvement in patients with CSOM. The procedure is effective in closing the air-bone gap, with stable postoperative outcomes over time.*

Keywords: Tympanoplasty, temporalis fascia, hearing improvement, CSOM, air-bone gap.

Introduction

Type I tympanoplasty is a common procedure in otology surgical practice and refers to the surgical repair of tympanic membrane perforations. The most accepted indications are the protection of the middle ear mucosa from infection through the external auditory canal and hearing improvement.[1] Tympanoplasty was first introduced by Berthold in 1878. Still, it was only in 1956

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that Wullstein developed fundamental principles for modern practice[2]. The underlay technique, described by Austin and Shea (1961)[3] has become widely recognized as one of the most successful techniques. Hough modified this technique by utilizing the temporalis fascia.[4] Different materials have been used to construct the tympanic membrane, the most accepted of which is temporalis fascia autograft and almost always the most favorable graft for its immunological compatibility.[5] Type I Tympanoplasty with or without mastoidectomy is indicated for chronic ear disease processes such as tympanic membrane perforation resulting from previous middle ear infections, trauma or iatrogenic causes,[6] atelectasis of tympanic membrane, retraction pocket, cholesteatomas, tympanosclerosis, and chronic otitis media with effusion or mastoid granuloma.[7] Hearing loss from tympanic membrane perforation is usually less than 45 dB and of conductive type.

More severe hearing loss is generally associated with ossicular abnormalities[8]. Conductive hearing loss from ossicular chain abnormalities may occur from either discontinuity or ossicular chain fixation. Ossiculoplasty is performed to repair or reconstruct the ossicular chain. Ossiculoplasty is required in 40%–90% of all tympano-plasties.[9] The goal of tympanoplasty is to restore sound pressure transformation at the oval window by coupling an intact tympanic membrane with a mobile stapes footplate via an intact or reconstructed ossicular chain and to provide sound protection for the round window membrane by a closed, air-containing, and mucosa-lined middle ear.[10] There is no universal agreement regarding the standard criteria for reporting hearing results. A variety of methods have been applied by several researchers to record post-op-erative hearing assessment in the literature, and the param-eters that are most often used are the mean (average) hearing gain, postoperative hearing level, and air-bone gap (ABG). Hearing improvement is usually defined as hearing gain exceeding 10 dB or 20 dB or reduction of ABG to within 10, 15, 20, or 30 dB or achievement of the social hearing (0-30 dB HL). The American Academy of Ophthalmology and Otology recommends average hearing gain at frequencies of 500-2000 Hz or a diminution of ABG, as measures of postoperative hearing outcomes.[11] The literature review suggests that among the different surgical modalities, the underlay technique is preferred by the ENT specialist for several reasons. However, fewer studies are noticed regarding the outcome of this proce-dure. Therefore, the current study aimed to compare pre-and postoperative hearing levels, following type1 tympanoplasty temporalis fascia graft underlay technique using pure tone average & investigate factors that may influence outcomes after tympanoplasty in terms of hearing improvement.

Materials and Methods

This was a cross-sectional study conducted at the Special-ized ENT Hospital (SENTH) of SAHIC between January and September 2019. The study focused on patients diagnosed with chronic suppurative otitis media (CSOM) and who underwent Type-I tympanoplasty using Tempora-lis Fascia Graft by the Underlay Technique. The study population consisted of 50 patients selected through purpo-sive convenient sampling. Due to the lack of relevant studies in Bangladesh, a sample size of 50 patients was determined based on a 50% prevalence estimate, with a 95% confidence interval and a 5% margin of error. This was calculated using the statistical formula for sample size estimation, yielding an ideal sample size of 96, but resource constraints led to the inclusion of 50 cases. The inclusion criteria were patients aged 15–45 years with clinical features consistent with inactive tubo-tympanic CSOM, who were scheduled for tympanoplasty using the Temporalis Fascia Graft Underlay Technique, and who were willing to participate in the study. Exclusion criteria included patients with congenital deafness, active CSOM, systemic diseases (such as diabetes, hypertension, or dyslipidemia), or those with ear conditions like atelectasis, retraction pockets, cholesteatomas, tympanosclerosis, or mastoid granulomas. Data were collected through struc-tured face-to-face interviews with the patients, using a questionnaire that covered socio-demographic details and pure tone audiometry (PTA) findings before and after surgery. Diagnosis and clinical profiles were also extracted from the patient registry files. All patients were interviewed and investigated, and the researcher personally conducted the interviews and recorded the data. After ensuring the consistency of the collected data, it was entered into a spreadsheet for analysis using SPSS 23. Ethical approval for the study was obtained from the Ethical Review Committee (ERC) of the Bangladesh College of Physicians and Surgeons (BCPS), and written informed consent was secured from each participant. Patients and their families were fully informed about the scope and limitations of the study, and confidentiality regarding personal information was strictly maintained. Data analysis was performed using SPSS version 23, with categorical variables presented as frequencies and percent-ages, and continuous variables reported as mean ± standard deviation. The outcomes were evaluated using the student's t-test, with statistical significance set at $p < 0.05$. Graphs and charts were generated using Microsoft Excel 2010.

Result

Figure 1: Age of the patients (N=50)

Age distribution of the patients
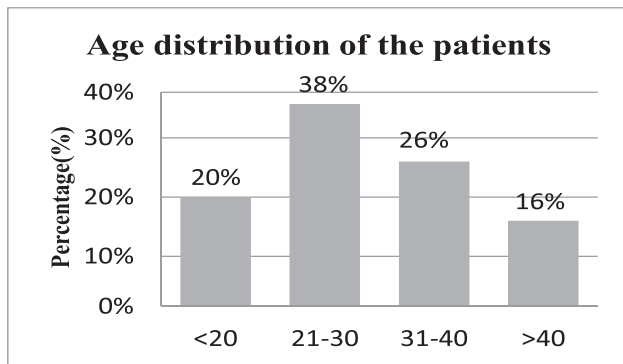
The mean age of the study cases was 28.96±8.91 years. Maximum 19 (38%) cases were in 21-30 years age group. Ten (20%) cases were in <20 years age group, 13 (26%) were in 31-40 years age group and 08 (16%) were in >40 years age group.

Figure 2: Sex distribution of patients (N=50)

Sex distribution of the cases
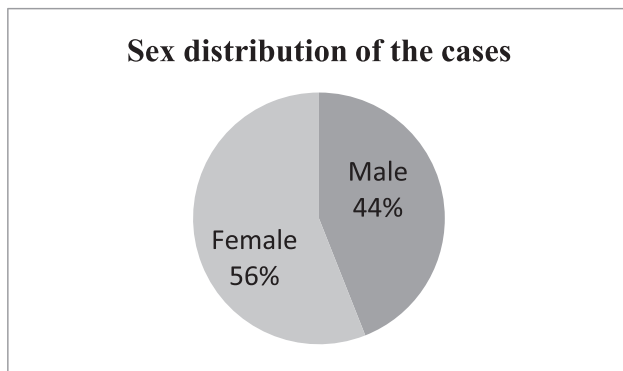
Among 50 patients maximum 28(56%) were female and 22(44%) were male.

Figure 3: Educational qualification of the patients (N=50)

Educational qualification of the cases
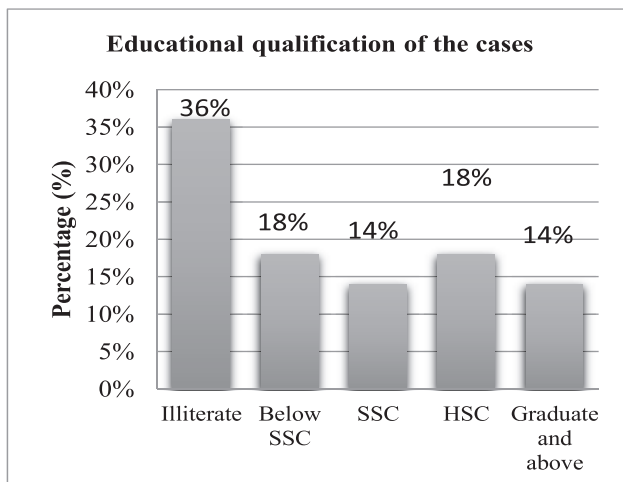
Among the study cases maximum of 18 (36%) of the cases were illiterate. Nine (18%) cases had educational qualifications below SSC, 07(14%) had educational qualifications up to SSC, 09 (18%) had educational qualifications up to HSC, and the rest 07(14%) had educational qualifications up to graduation or above.

Table 1: Clinical features present among the patients (N=50)

Symptoms		Number of patients	Percentage (%)
Earache	Yes	05	10
	No	45	90
Hearing impairment	Yes	50	100
	No	00	00
Tinnitus	Yes	10	20
	No	40	80

Among 50 study cases, all cases had hearing impairment. Earache was present in 05 (10%) patients. Tinnitus was present in 12 (24.00%) patients.

Figure 4: Types of perforation among the patients (n=90)

Type of perforation
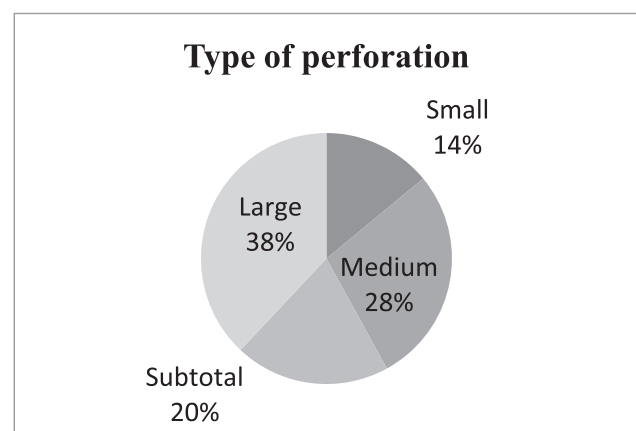
Out of 50 study cases maximum 19 (38%) cases had large perforation, 10 (20%) had subtotal perforation, 14 (28%) had medium perforation and 07 (14%) had small perforation.

Table 2: Preoperative and postoperative air conduction threshold among the patients (n=50)

Air conduction	Before operation Mean±STD (dB)	After operation (at 6th week) Mean±STD (dB)	P value
500Hz	42.20±5.64	28.00±3.98	<0.001
1000Hz	43.40±5.07	28.22±3.78	<0.001
2000Hz	42.40±5.22	28.84±3.84	<0.001
4000Hz	41.06±4.23	29.00±3.25	<0.001
Overall	42.27±4.59	28.51±3.38	<0.001

The mean preoperative air-conduction at 500Hz, 1000Hz, 2000Hz, and 4000Hz were 42.20±5.64 dB, 43.40±5.07 dB, 42.40±5.22 dB, and 41.06±4.23 dB respectively. The mean postoperative air-conduction at 6th week follow-up at 500Hz, 1000Hz, 2000Hz and 4000Hz were 28.00±3.98 dB, 28.22±3.78 dB, 28.84±3.84 and 29.00±3.25 dB respectively. After operation air conduction was reduced statistically significantly at all frequencies (p<0.001 for all frequencies).

Table 3: Preoperative and postoperative bone conduction threshold among the patients (n=50)

Bony conduction	Before operation Mean±STD (dB)	After operation (at 6th week) Mean±STD (dB)	P value
500Hz	16.70±3.99	14.58±3.77	<0.001
1000Hz	16.58±3.92	15.60±3.43	0.009
2000Hz	15.86±14.92	14.92±2.67	0.033
4000Hz	17.52±15.76	15.76±3.05	<0.001
Overall	16.58±3.62	15.22±2.95	<0.001

The mean preoperative bone conduction threshold at 500Hz, 1000Hz, 2000Hz, and 4000Hz were 16.70±3.99 dB, 16.58±3.92 dB, 15.86±14.92dB, and 17.52±15.76 dB respectively. The mean postoperative bone conduction threshold at the 6th week followed up at 500Hz, 1000Hz, 2000Hz, and 4000Hz were 14.58±3.77dB, 15.60±3.43dB,

14.92±2.67 dB and 15.76±3.05 dB respectively. After operation bone conduction threshold was also reduced statistically significantly at all frequencies (p<0.001, 0.009, 0.033, and <0.001).

Table 4: Preoperative and postoperative air-bone gap among the patients (n=50)

ABG (air-bone gap)	Before operation Mean±STD (dB)	After operation (at 6th week) Mean±STD (dB)	P value
500Hz	25.50±6.07	13.42±4.59	<0.001
1000Hz	26.82±5.46	12.62±4.42	<0.001
2000Hz	26.54±5.91	13.10±4.15	<0.001
4000Hz	23.54±5.95	13.24±3.76	<0.001
Overall	25.60±5.37	13.10±3.85	<0.001

The preoperative mean air-bone gap at 500Hz, 1000Hz, 2000Hz, and 4000Hz were 25.50±6.07 dB, 26.82±5.46 dB, 26.54±5.91 dB and 23.54±5.95 dB. The postoperative mean air-bone gap at 6th-week follow-up at 500Hz, 1000Hz, 2000Hz and 4000Hz were 13.42±4.59 dB, 12.62±4.42 dB, 13.10±4.15 dB, and 13.24±3.76 dB respectively. After the operation, the mean air-bone gap was statistically significantly reduced at all frequencies (p< 0.001 for all frequencies).

Table 5: Mean air conduction among the patients at 6th week, 3rd month and 6th month follow up (N=50)

Frequency	Mean air conduction (at 6th week)	Mean air conduction (at 6th month)	Mean Air conduction (at 6th month)
500Hz	28.00±3.98	24.63±3.16	24.44±2.32
1000Hz	28.22±3.78	26.28±2.96	24.76±2.76
2000Hz	28.84±3.84	26.02±3.56	25.13±2.82
4000Hz	29.00±3.25	25.17±3.34	25.89±3.02
Overall	28.51±3.38	25.53±3.06	25.05±2.89

The overall mean postoperative air conduction threshold at the 6th week, 3rd month, and 6th-month follow-up was 28.51±3.38 dB, 25.53±3.06dB, and 25.05±2.89 dB respectively.

Table 6: Mean bone conduction among the patients at 6th week, 3rd month and 6th month follow up (N=50)

Frequency	Mean bone conduction (at 6th week)	Mean bone conduction (at 3rd month)	Mean bone conduction (at 6th month)
500Hz	14.58±3.77	13.23±1.74	12.96±2.76
1000Hz	15.60±3.43	14.58±1.94	13.28±3.03
2000Hz	14.92±2.67	13.76±1.85	14.56±3.33
4000Hz	15.76±3.05	14.76±2.34	14.76±2.86
Overall	15.22±2.95	14.08±2.06	13.90±3.16

The overall mean postoperative bone conduction threshold at the 6th week, 3rd month and 6th month follow-up was 15.22±2.95 dB, 14.08±2.06 dB, and 13.90±3.16 dB respectively.

Discussion

Chronic suppurative otitis media is an important public health issue despite significant advancements in medical science. Hearing impairment is one of the most devastating consequences of CSOM.[12] Hearing loss in CSOM is usually conductive type and the normal mechanism behind this is alteration of sound conduction from the external ear to the inner ear.[13] Tympanoplasty is usually performed to restore the normal mechanism of sound transmission to improve the hearing status of CSOM patients.[14] This hospital-based cross-sectional study was done to describe the outcome of type-I tympanoplasty by temporalis fascia graft underlay technique. The study was conducted in the Specialized ENT hospital (SENTH) of SAHIC with 50 study cases of CSOM who fulfilled inclusion and exclusion criteria and underwent type-I tympanoplasty by temporalis fascia graft underlay technique.

Among the study cases, a maximum of 19 (38%) were in the 21-30 years age group. Ten (20%) cases were in the <20 years age group, 13 (26%) were in 31-40 years age group and 08 (16%) were in >40 years age group. The mean age of the patients was 28.96±8.91 years. The study conducted by Karanjai and associates also found similar results in their study.[15] Among their 46 study cases maximum of 14 (30.43%) cases were in 20-29 years age group. The study conducted by Sharma and associates and Das and associates also found maximum of their cases in 21-40 years age group.[42,43] Another study conducted by Aich and associ-

ates found the mean age 27 years which is consistent with the findings of this study.[16]

Among the study cases, a maximum 28 (56%) were female and 22(44%) were male. The study conducted by Karanjai and associates also found similar results in their study.[15] Among their 46 study cases 24(52.20%) cases were female. The study conducted by Fernandes and co-researchers and Sheikh also found 57% and 66.70% of their cases in the female sex group respectively.[17,18]

According to Tabassum and associates, Jain and associates, and Kaur and associate's incidence of CSOM was relatively more common in rural, illiterate, and poor people.[19-21] Consistent with their findings this study also reveals almost similar results. Among the 50 study cases of this study maximum of 32 (64%) were rural residents, a maximum 18 (36%) were illiterate, and a maximum 18 (36%) cases had monthly income <10000 BDT.

Among 50 study cases, earache was present in 05 (10%) cases, tinnitus was present in 10 (20%) cases and 50 (100%) cases had hearing impairment. This finding is similar to the findings of Shetty and Kabdwal and co-researchers.[22,13] A Study conducted by Shetty found Hearing impairment in 100% of cases, earache in 24% of cases, and tinnitus in 18% of cases which is consistent to the findings of this study. Another study conducted by Sharma and associates found hearing impairment in their 95% cases, earache in 3.75% cases and tinnitus in 6.25% cases.[23]

Among the study cases maximum 38% cases had large perforation, 28% medium, 20% subtotal and 14% had small perforation which are based on quadrant measurement of TM. This finding is similar to the findings of Aslam and associates.[24] Among their study cases maximum 56% had subtotal perforation. Adegbiji and associates observed central perforation among their 38.2% cases which is consistent to the findings of this study.[25]

The mean air-conduction threshold at 500Hz, 1000Hz, 2000Hz and 4000Hz were statistically significantly reduced following operation (p<0.001 for all frequencies). Before operation, the mean air conduction threshold at 500Hz, 1000Hz, 2000Hz and 4000Hz were 42.20±5.64 dB, 43.40±5.07 dB, 42.40±5.22 dB and 41.06±4.23 dB respectively.

Before operation the overall mean air conduction threshold was 42.27±4.59 dB and after operation overall mean air conduction threshold was 28.51±3.38 dB. The overall means was also statistically significantly reduced following operation (p<0.001). This finding is similar to the findings of Tuz and associates and Aslam and associates.[23,26] According to Aslam et al mean air-conduction threshold before the operation was 45 dB and the mean air-conduction threshold after the operation was 30 dB. According to Tuz and associates, the mean air conduction threshold before operation was 38.6±15.70 dB and the mean air conduction threshold after operation was 27.90±12.10 dB (p<0.001).

The mean bone conduction threshold at 500Hz, 1000Hz, 2000Hz and 4000Hz were also statistically significantly reduced following operation (p<0.001, 0.009, 0.033 and <0.001 respectively). Before operation the mean bone conduction threshold at 500Hz, 1000Hz, 2000Hz and 4000Hz were 16.70±3.99 dB, 16.58±3.92 dB, 15.86±14.92dB and 17.52±15.76 dB respectively. Before operation the overall mean bone conduction threshold was 16.58±3.62 dBs and overall mean bone conduction threshold after operation was 15.13±2.91 dB. The overall means was also statistically significantly reduced following operation (p<0.001). The study conducted by Vijayendra and colleague and Tuz and colleagues also shown a significant reduction of mean bone conduction threshold following tympanoplasty operation in their respective study[26,27]. According to Tuz and associates bone conduction threshold before operation was 13.6±7.7 dB and after the operation the mean bone conduction threshold was 12.5±6.1 dB (p=0.037). According to Vijayendra and colleagues, the mean bone conduction threshold before the operation was 16.1±10.3 dB and after the operation, the mean bone conduction threshold was 6.4±8.6 dB (p<0.001).

The preoperative mean air-bone gap was also statistically significantly reduced following operation at all frequencies (p<0.001 for all frequencies). Before operation mean air bone gap at 500Hz, 1000Hz, 2000Hz and 4000Hz were 25.50±6.07 dB, 26.82±5.46 dB, 26.54±5.91 dB and 23.54±5.95 dB. After operation mean air bone gap at 500Hz, 1000Hz, 2000Hz and 4000Hz were 13.42±4.59 dB, 12.62±4.42 dB, 13.10±4.15 dB and 13.24±3.76 dB respec-

tively. The overall mean air-bone gap before operation was 25.60±5.37 dB. This mean was also statistically significantly reduced to 13.10±3.85 dB following operation (p<0.001). Kucukkavruk and associates, El-sheikh, Batni and associates, and Karanjai and colleagues also observed significant reduction of mean air-bone gap following the operation in their respective studies.[15,18,28,29] According to Sheikh mean air-bone gap before operation was 25±10.20 dB and the mean postoperative air-bone gap was 15.9±8.7 dB (p<0.001). According to Kucukkavruk and associates mean ABG before the operation was 25.36±9.9 dB and after the operation the mean was 17.36±11.68 dB (p=0.001).

The mean postoperative air conduction, bone conduction and air-bone gap were observed at 6th week, 3rd month, and 6th month following the operation. The overall mean postoperative air conduction threshold was 28.51±3.38 dB, 25.53±3.06dB and 25.05±2.89 dB at 6th week, 3rd month and 6th month, respectively. The overall mean postoperative bone conduction threshold was 15.22±2.95 dB, 14.08±2.06 dB and 13.90±3.16 dB at 6th week, 3rd month and 6th month, respectively. The overall mean air-bone gap was 13.10±3.85 dB, 12.92±3.90 dB and 13.90±3.16 dB at 6th week, 3rd month and 6th month follow up respectively. At final follow up (at 6th month) satisfactory hearing improvement and graft acceptance were observed in 42(84%) cases and in 16% cases hearing improvement and graft acceptance was not satisfactory. Study conducted by Thakur and associates also observed satisfactory hearing improvement (ABG <20db) among their 82.80% cases and Baklaci and associates observed satisfactory hearing improvement (ABG <20 dB) among their 74.50% cases which is also nearly consistent to the finding of this study[28,29].

Conclusion

Overall improvement of air conduction and bone conduction occurred following operation and was evident in subsequent follow-up. Moreover, overall reduction of the mean air bone gap also observed. Based on the findings, it can be concluded that the Temporalis Fascia Graft by Underlay Technique could be used in type-I Tympanoplasty and could bear positive outcomes in patients.

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Original Article

HPV Vaccine Awareness and Preventive Practices Among Female Healthcare Providers in Bangladesh: A Cross-Sectional Survey

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Abstract

Background: *Human papillomavirus (HPV) is a significant cause of cervical cancer worldwide, yet vaccination coverage remains suboptimal, particularly in low- and middle-income countries like Bangladesh. Healthcare providers, especially nurses play a crucial role in promoting vaccination, but their knowledge and preventive practices regarding the HPV vaccine are often inadequate.* ***Objective:*** *This study aimed to assess the awareness of the HPV vaccine and preventive practices among female healthcare providers in Bangladesh, specifically focusing on nurses and midwives.* ***Methods:*** *A cross-sectional survey was conducted between January and December 2024, involving 190 nurses from 16 Upazila Health Complexes in Khulna and Jashore—a structured, pre-tested questionnaire collected data on demographic characteristics, HPV vaccine awareness, and preventive practices.* ***Results:*** *The study revealed that 64.7% of participants were aware that HPV causes cervical cancer, but only 41.1% knew that the HPV vaccine prevents it. Additionally, 52.1% were aware of the vaccine's availability, and only 11.1% had received the vaccine themselves. Awareness was significantly higher among younger healthcare workers (≤35 years) and those with higher educational levels. Barriers to vaccination included lack of awareness (46.8%), cost (29.5%), and limited accessibility (16.3%).* ***Conclusion:*** *The study highlights significant gaps in HPV vaccine awareness and preventive practices among healthcare providers in Bangladesh. Increased education, policy support to reduce barriers, and targeted interventions are necessary to improve vaccine uptake and promote public health.*

Keywords: HPV vaccine, healthcare providers, awareness, preventive practices, Bangladesh.

Introduction

Globally, an estimated 500,000 women are diagnosed with cervical cancer each year, resulting in more than 270,000 deaths. Despite being highly preventable, cervical cancer

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predominantly occurs in low-resource countries, where nearly 9 out of 10 cases (87%) are found[1]. In South Asia, the age-standardized incidence rate for cervical cancer is 18.9 per 100,000 women, compared to an average of approximately 10 per 100,000 in developed countries[2,3]. In Bangladesh, cervical cancer is the second most common cancer among women, with 12,000 new cases diagnosed annually[4]. Similar to other low-resource settings, the true burden of cervical cancer in Bangladesh is largely underestimated due to the absence of national cancer registries and a significant number of undiagnosed cases, which are notably prevalent[5]. Limited data from hospitals in Bangladesh indicate that cervical cancer accounts for about a quarter of cancer-related deaths among women, a statistic not reflected in national estimates[6,7]. Persistent infection with high-risk human papillomavirus (HPV) has been identified as a necessary cause of cervical cancer[8]. Globally, 70% of cervical cancer cases are attributed to high-risk HPV subtypes 16 and 18. 9 Other high-risk

subtypes, including 31, 33, 35, 45, 52, and 58, in various combinations with 16 and 18, are responsible for 90% of the global disease burden[10]. Primary prevention of cervical cancer through HPV vaccination and secondary prevention via screening are the most effective strategies for preventing invasive cervical cancer[11]. In developed countries, organized screening programs have led to a decrease in cervical cancer incidence through early detection and the successful treatment of precancerous lesions[12,13]. However, regular screening remains out of reach for many developing countries due to high costs, limited healthcare infrastructure, competing health priorities, and a shortage of healthcare personne[15, 14-16]. In contrast, HPV vaccination offers a feasible solution for low-resource settings like Bangladesh, providing an opportunity to reduce cervical cancer burden through primary prevention and widespread vaccination uptake among adolescents[12]. In 2016, the Ministry of Health in Bangladesh introduced the HPV vaccine with support from the Global Alliance for Vaccines and Immunizations (GAVI). The vaccination program was initially rolled out for two years in one district, with plans for national implementation if the program was successful[17]. To establish an effective national HPV vaccination strategy, data on women's knowledge and attitudes toward cervical cancer and its prevention are essential across various societal segments. A 2018 cross-sectional study of Bangladeshi women with low educational attainment (average : ~7 years of education) and low income showed that, despite limited knowledge of cervical cancer, there was a high willingness to receive the HPV vaccine[18]. Another study conducted in rural Bangladesh found that although 81% of women were aware of cervical cancer, the study was limited to women over 30 years old and did not examine their willingness to vaccinate themselves or their daughters[19]. In contrast, an African study20 found that low awareness was associated with a greater willingness to vaccinate children but not themselves. To our knowledge, no studies have specifically assessed cervical cancer knowledge, HPV awareness, and HPV vaccination acceptance among Bangladeshi women with higher educational backgrounds and socioeconomic status. Data from this subgroup are needed to design targeted educational programs that can optimize HPV vaccination uptake in Bangladesh. This study aims to assess HPV vaccine awareness and preventive practices among healthcare providers in Bangladesh, offering insights to guide future vaccination strategies.

Materials and Methods
The study utilized a cross-sectional survey design to evaluate HPV vaccine awareness and preventive practices among nurses and midwives in Bangladesh. The research was conducted in 16 Upazila Health Complexes across Khulna and Jashore districts, ensuring a broad and representative sample and the study period extended from January to December 2024. A total of 190 nurses participated in the study, selected through purposive sampling to target relevant healthcare providers. Data were collected using a structured questionnaire, which was pre-tested to ensure reliability and validity. The questionnaire covered demographic information, levels of awareness regarding the HPV vaccine, and preventive practices. Participants provided informed consent before data collection, ensuring ethical compliance. Ethical approval for the study was obtained from the appropriate institutional review board. Data were systematically analyzed to identify key insights into HPV vaccine awareness and practices among this crucial segment of healthcare providers.

Results
A total of 190 nurses and midwives participated in the study. The mean age of participants was 34.5 years (±7.2). Sociodemographic factors, awareness levels, and preventive practices were analyzed. Statistical significance was evaluated using chi-square tests, with p-values < 0.05 considered significant.

Table 1: Sociodemographic Characteristics of Participants (n = 190)

Characteristic	n (%)
Age (years)	
20–29	56 (29.5)
30–39	92 (48.4)
40–49	32 (16.8)
≥50	10 (5.3)
Educational Qualification	
Diploma in Nursing	133 (70.0)
Bachelor in Nursing	41 (21.6)
Master in Nursing	16 (8.4)
Marital Status	
Married	161 (84.7)
Single	25 (13.2)
Divorced/Widowed	4 (2.1)
Work Experience (years)	
≤5 years	54 (28.4)
6–10 years	79 (41.6)
>10 years	57 (30.0)

Table 1 shows that the majority of participants were aged 30–39 years (48.4%) and had a diploma in nursing (70%). Most were married (84.7%) and had between 6–10 years of work experience (41.6%).

Table 2: Awareness of HPV and HPV Vaccine (n = 190)

Variable	Aware n (%)	Not Aware n (%)	p-value
HPV Causes Cervical Cancer	123 (64.7)	67 (35.3)	0.041*
HPV Vaccine Availability	99 (52.1)	91 (47.9)	0.028*
HPV Vaccine Prevents Cancer	78 (41.1)	112 (58.9)	<0.001*
Recommended Age for Vaccine	67 (35.3)	123 (64.7)	<0.001*

Table 2 highlights that 64.7% of participants were aware that HPV causes cervical cancer. However, awareness of the vaccine's role in cancer prevention was significantly lower (41.1%, $p < 0.001$). Awareness of vaccine availability and the recommended age for vaccination was also suboptimal.

Table 3: Preventive Practices Related to HPV Vaccination (n = 190)

Variable	Yes n (%)	No n (%)	p-value
Ever Discussed HPV Vaccine	91 (47.9)	99 (52.1)	0.062
Ever Received HPV Vaccine	21 (11.1)	169 (88.9)	<0.001*
Recommended Vaccine to Others	73 (38.4)	117 (61.6)	<0.001*
Screened for Cervical Cancer	49 (25.8)	141 (74.2)	<0.001*

Table 3 shows that only 11.1% of participants had received the HPV vaccine, and 38.4% had recommended it to others. Screening for cervical cancer was also low (25.8%, $p < 0.001$).

Table 4: Barriers to HPV Vaccine Uptake (n = 190)

Barrier	n (%)
Lack of Awareness	89 (46.8)
Cost of Vaccine	56 (29.5)
Limited Accessibility	31 (16.3)
Cultural/Religious Beliefs	14 (7.4)

Table 4 indicates that the most common barrier to HPV vaccine uptake was a lack of awareness (46.8%), followed by the cost of the vaccine (29.5%). Cultural or religious beliefs played a minor role (7.4%).

Table 5: Sociodemographic Predictors of HPV Vaccine Awareness (n = 190

Predictor	Aware n (%)	Not Aware n (%)	p-value
Age			
≤35 years	67 (55.4)	54 (44.6)	0.047*
>35 years	56 (42.7)	75 (57.3)	
Education Level			
Diploma	71 (53.4)	62 (46.6)	0.032*
Bachelor's/Master's	52 (68.4)	24 (31.6)	
Work Experience			
≤5 years	29 (53.7)	25 (46.3)	0.061
>5 years	94 (51.4)	89 (48.6)	

Table 5 shows that younger participants (≤35 years) and those with higher education levels were significantly more likely to be aware of the HPV vaccine ($p < 0.05$). Work experience did not show a significant association.

Table 6: HPV Vaccine Awareness and Preventive Practices by District (n = 190)

District	Aware of Vaccine n (%)	Ever Screened n (%)	Received Vaccine n (%)
Khulna	67 (56.8)	28 (23.7)	15 (12.7)
Jashore	56 (47.5)	21 (17.8)	6 (5.1)
Combined	123 (52.1)	49 (25.8)	21 (11.1)

Table 6 revealed that participants in Khulna had better awareness (56.8%) and vaccine uptake (12.7%) compared to those in Jashore (47.5% awareness, 5.1% vaccine uptake).

Discussion

The findings from this study highlight significant gaps in HPV vaccine awareness and preventive practices among female healthcare providers in Bangladesh, particularly nurses and midwives. The results underscore the need for targeted educational interventions and increased accessibility to HPV vaccines. Below, we discuss these findings in the context of existing literature.

In our study, 64.7% of participants were aware that HPV causes cervical cancer, but only 41.1% were aware that the HPV vaccine prevents cervical cancer (Table 2). This is consistent with findings from a study, where only 40% of healthcare workers in China had comprehensive knowledge about the HPV vaccine's protective role against cervical cancer[21]. The lower awareness in our study may be attributed to the lack of formal education on HPV among healthcare providers in rural and semi-urban areas of Bangladesh. This aligns with the studies, who found that healthcare providers in resource-limited settings often have limited access to continuous professional development programs on emerging health threats like HPV[22].

Moreover, only 52.1% of participants were aware of the availability of the HPV vaccine, and 35.3% were aware of the recommended vaccination age (Table 2). This finding is concerning, given that healthcare providers are expected to be well-informed on preventative measures. Similarly, researches in Ethiopia found that 50% of healthcare workers had limited awareness about vaccine availability, which directly impacts their ability to recommend vaccination to patients23. Inadequate awareness and knowledge may lead to missed opportunities for vaccination, which is a significant barrier to preventing HPV-related cervical cancer.

When it comes to preventive practices, only 11.1% of participants reported having received the HPV vaccine themselves (Table 3). This is substantially lower than what was reported in a study conducted by authors, which showed that 35% of healthcare workers in Taiwan had received the vaccine[24]. The low uptake in our study is concerning because healthcare workers are crucial in promoting vaccination among the general public. Their reluctance to vaccinate may reflect broader societal hesitations, such as vaccine-related myths, concerns about vaccine safety, or lack of institutional support for vaccination. Further, 38.4% of participants reported recommending the HPV vaccine to others, which is similar to findings in the Netherlands, where approximately 40% of healthcare providers recommended the vaccine to patients[25]. The lower rate of recommendation in Bangladesh may be due to a lack of patient education materials or insufficient institutional endorsement of the vaccine in local healthcare settings. A key barrier identified in this study was the lack of awareness (46.8%), followed by cost (29.5%) and limited accessibility (16.3%) (Table 4). These findings are consistent with a study that highlighted that financial barriers, limited access, and misinformation were major obstacles to HPV vaccination in both the general public and healthcare professionals[26]. In Bangladesh, the cost of the vaccine, along with its availability in rural areas, remains a significant challenge. The government and international health organizations must address these barriers through policy initiatives that make the vaccine more affordable and accessible, particularly in underserved regions. In our study, younger participants (≤35 years) and those with higher education levels were more likely to be aware of the HPV vaccine (Table 5). This is consistent with researchers who found that younger healthcare workers in Bangladesh demonstrated greater awareness of the HPV vaccine than older workers[27]. This trend could be due to greater exposure to modern healthcare information among younger healthcare workers, particularly those who have recently graduated. Furthermore, higher educational qualifications were associated with better vaccine knowledge, as confirmed by authors, who found that healthcare providers with more advanced education levels had a higher level of awareness and were more likely to engage in preventive practices[25].

Conclusion

This study underscores the need for enhanced educational programs for healthcare providers on the HPV vaccine, its availability, and its critical role in preventing cervical cancer. Healthcare systems should integrate HPV vaccination education into routine healthcare training to bridge the knowledge gap. Additionally, addressing barriers such as cost and accessibility through government policies will be vital to improve vaccine uptake. Given the regional disparities identified, targeted interventions in regions like Jashore are necessary to ensure equitable healthcare practices across the country. Future studies should explore the effectiveness of educational interventions and examine strategies to reduce the barriers to vaccination among healthcare providers in Bangladesh.

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Original Article

Incidence and Patterns of Road Traffic Accidents Involving Children in Rural Areas of Bangladesh

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Abstract

Background: Road traffic accidents (RTAs) are a growing public health concern, particularly in low- and middle-income countries like Bangladesh, where inadequate road safety measures and regulatory frameworks exacerbate the risk. Objective: This study investigates the incidence, patterns, and risk factors associated with RTAs involving children in rural Bangladesh. Methods: This cross-sectional study was conducted over 12 months from July 2023 to June 2024, focusing on children aged 0–18 involved in RTAs on public roads in rural areas. Data were collected from police, hospital records, and guardian/witness interviews for cases not officially reported. Results: Among 290 cases, the most affected age group was 10–14 years (36.2%), with a higher prevalence in males (58.6%). RTAs were more common on village roads (62.1%) than rural highways (37.9%), and motorcycles were involved in 41.4% of accidents. Most accidents occurred in the afternoon (44.8%). Moderate injuries were most common, with severe and fatal injuries significantly higher among older children (15–18 years). Low usage of safety measures (helmets: 10.3%, seatbelts: 5.2%) and lack of adult supervision (58.6%) were prevalent. Logistic regression identified age (10–14 years), male gender, and lack of safety measures as significant predictors of severe injuries. Conclusion: RTAs among children in rural Bangladesh are predominantly influenced by inadequate road safety measures and insufficient supervision. The findings underscore the need for targeted interventions, including road safety education, stricter enforcement of safety measures, and improved infrastructure to protect children.

Keywords: Road traffic accidents, children, rural areas, safety measures

Introduction

Globally, an estimated 500,000 women are diagnosed with cervical cancer each year, resulting in more than 270,000 deaths. Despite being highly preventable, cervical cancer

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predominantly occurs in low-resource countries, where nearly 9 out of 10 cases (87%) are found1. In South Asia, the age-standardized incidence rate for cervical cancer is 18.9 per 100,000 women, compared to an average of approximately 10 per 100,000 in developed countries[2,3]. In Bangladesh, cervical cancer is the second most common cancer among women, with 12,000 new cases diagnosed annually[4]. Similar to other low-resource settings, the true burden of cervical cancer in Bangladesh is largely underestimated due to the absence of national cancer registries and a significant number of undiagnosed cases, which are notably prevalent[5]. Limited data from hospitals in Bangladesh indicate that cervical cancer accounts for about a quarter of cancer-related deaths among women, a statistic not reflected in national estimates[6,7]. Persistent infection with high-risk human papillomavirus (HPV) has been identified as a necessary cause of cervical cancer8. Globally, 70% of cervical cancer cases are attributed to high-risk HPV subtypes 16 and 18.[9] Other high-risk

Road traffic accidents (RTAs) are a significant and escalating public health issue globally, particularly in low- and middle-income countries where road safety infrastructures and regulatory frameworks may be limited1. In Bangladesh, the problem is particularly acute, with some of the highest fatality rates associated with RTAs worldwide. Currently, Bangladesh reports over 40 fatalities per 10,000 registered motor vehicles, and road traffic injuries contribute to a substantial economic loss, estimated at 2-3% of the country's GDP1,[3-5]. RTAs have a severe impact on public health, with around 12,000 fatalities and 35,000 injuries occurring annually in Bangladesh (Accident Research Institute, ARI)[2]. Rural areas bear the highest burden, with over 70% of RTA fatalities occurring in these regions, particularly along rural sections of national highways[2]. The prevalence of RTAs involving children is especially concerning, given their vulnerability and dependence on adults for safety[6].

The primary types of accidents involving children in Bangladesh include pedestrian hits, rear-end collisions, and overturning incidents. Pedestrian accidents account for about 45% of all fatal accidents, with 61% of urban RTA fatalities involving pedestrians (ARI). Other accident types such as rear-end collisions (16.5%) and head-on collisions (13%) are also common, highlighting the diverse risk landscape that exists for road users[5,6]. Heavy vehicles, including trucks and buses, contribute significantly to fatal accidents, with buses/minibuses and trucks accounting for 33% and 27% of these incidents, respectively. Among children, the incidence of fatal accidents is high, with road injuries being a leading cause of death for children aged 10-14, accounting for about 21% of fatalities in this age group[7].

A variety of factors contribute to the high rates of RTAs in Bangladesh, including inadequate road safety measures, adverse roadway conditions, insufficient road design, and risky driver behaviors. A mix of motorized and non-motorized vehicles adds to the complexity, increasing the likelihood of accidents, particularly in crowded and high-traffic areas. Economic expansion and rapid urbanization have also resulted in an unprecedented increase in vehicle ownership, which is expected to double within the next decade[7,8].

In response to the growing burden of RTAs on children, this study aims to investigate the incidence and patterns of RTAs involving children in rural areas of Bangladesh, with a focus on demographic factors, accident types, and contributing conditions. This cross-sectional study provides valuable insights into the risk factors affecting children on rural roads, offering an evidence base for policymakers to develop and implement targeted road safety measures.

Materials and Methods
This cross-sectional study examined the incidence and patterns of road traffic accidents (RTAs) involving children aged 0-18 in rural areas of Gazipur, Bangladesh, over 12 months (July 2023 to June 2024). Gazipur was chosen due to its mix of urban and rural settings and diverse socio-economic and road conditions, making it representative of many rural Bangladeshi districts. The study targeted children injured or fatally wounded in RTAs on public roads. Private road accidents and non-public area incidents were excluded. A sample size of 290 cases was determined based on prior RTA incidence rates in rural areas.

Data was gathered through multiple sources: police records, hospital and clinic records, and, where official records were unavailable, interviews with parents, guardians, and witnesses. A structured data collection form was used to record key information, including the child's age, gender, accident location, road conditions, vehicle type, and injury severity. Additionally, a questionnaire assessed potential risk factors, such as road safety measures, parental supervision, and the child's behavior during the accident.

Descriptive statistics were used to summarize demographic and accident-related data, with further analysis of variables like age, gender, socio-economic status, road type, time of day, and weather. Injury severity was classified as minor, moderate, severe, or fatal. Chi-square tests examined differences in accident types and injury severity, while logistic regression identified predictors of child involvement in RTAs, adjusting for confounders like socioeconomic status and parental education. The geospatial analysis identified accident hotspots within the district. Ethical approval was obtained from the relevant institutional review board (IRB) of Khulna City Medic, with informed consent from parents or guardians. Data confidentiality was maintained through anonymization. Despite potential limitations, such as underreporting and recall bias, this study aims to guide policy and public health efforts to improve road safety for children in rural Bangladesh, especially in Gazipur.

Result

Figure 1: Age of the children

Age
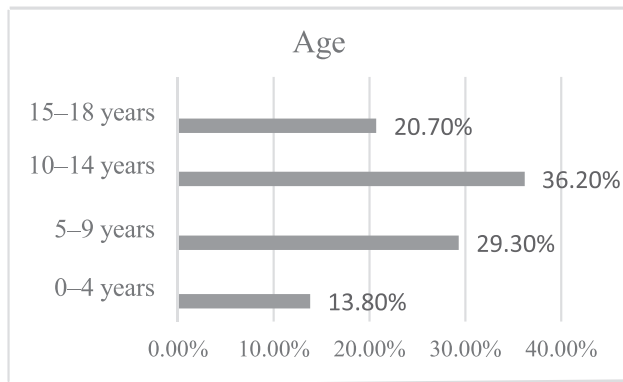
Figure 1 shows the distribution of participants by age group. The largest proportion of cases were in the 10–14 years age group, accounting for 36.2% of the sample. This was followed by the 5–9 years group at 29.3%, and the 15–18 years group at 20.7%. The 0–4 years group made up the smallest proportion, with 13.8% of cases.

Figure 2: Gender of the children
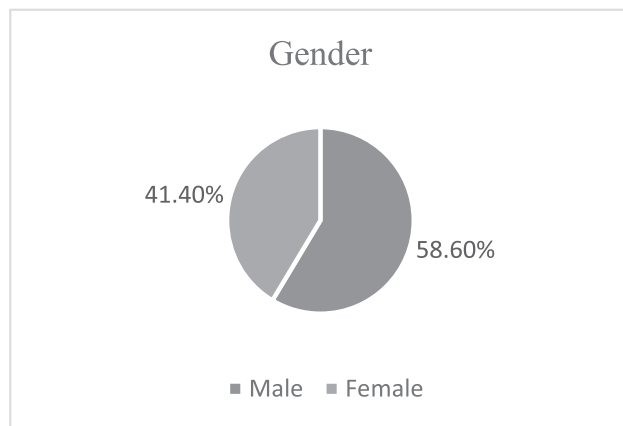
Gender

Figure 2 illustrates the gender distribution of the participants. The study population consisted of 58.6% males and 41.4% females, indicating a higher prevalence of the condition among males.

Table 1: Accident Circumstances by Type of Road (Village Roads vs. Rural Highways) (n=290)

Road Type	Frequency of Accidents (n)	Percentage (%)	p-value
Village Roads	180	62.1%	<0.05
Rural Highways	110	37.9%	

Table 1 illustrates accident distribution by road type. Most accidents occurred on village roads (62.1%), which was statistically significant compared to rural highways (p < 0.05).

Table 2: Type of Vehicle Involved in Accidents (n=290)

Vehicle Type	Frequency (n)	Percentage (%)
Motorcycles	120	41.4%
Bicycles	80	27.6%
Cars	50	17.2%
Trucks	30	10.3%
Other	10	3.5%

Table 2 shows that motorcycles were the most frequently involved vehicles (41.4%), followed by bicycles (27.6%).

Table 3: Distribution of Accidents by Time of Day (n=290)

Time of Day	Frequency (n)	Percentage (%)	p-value
Morning (6 AM-12 PM)	85	29.3%	<0.05
Afternoon (12 PM-6 PM)	130	44.8%	
Evening (6 PM-12 AM)	60	20.7%	
Night (12 AM-6 AM)	15	5.2%	

Table 3 indicates that accidents were most frequent in the afternoon (44.8%), followed by the morning (29.3%), with statistically significant variations in accident times (p < 0.05).

Table 4: Injury Severity by Age Group (n=290)

Age Years	Injury				Total	Total (%)
	Minor	Moderate	Severe	Fatal		
0–4	10 (25.0%)	15 (37.5%)	10 (25.0%)	5 (12.5%)	40	13.8%
5–9	20 (23.5%)	30 (35.3%)	25 (29.4%)	10 (11.8%)	85	29.3%
10–14	30 (28.6%)	40 (38.1%)	25 (23.8%)	10 (9.5%)	105	36.2%
15–18	10 (16.7%)	20 (33.3%)	20 (33.3%)	10 (16.7%)	60	20.7%

Table 4 provides injury severity data within each age group. Moderate injuries were most common across all groups, especially in the 10–14 years age group (38.1%). Severe and fatal injuries were proportionately higher in the 15–18 age group (33.3% and 16.7%, respectively).

Figure 4: Road Safety Measures at the Time of Accident (n=290)
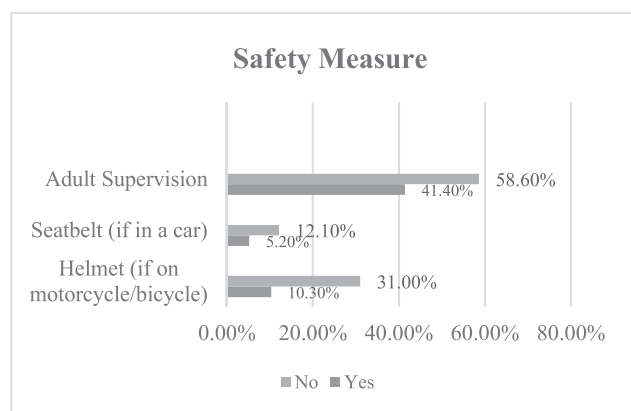
Figure 4 reveals that only a small percentage of children used helmets (10.3%) or seatbelts (5.2%) at the time of the accident, and nearly 60% lacked adult supervision

Table 5: Logistic Regression Analysis of Factors Associated with Severe or Fatal Injuries (n=290)

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (10-14 years vs. others)	2.5	1.4–4.5	<0.01
Male Gender	1.8	1.1–3.0	<0.05
No Safety Measures	3.2	1.8–5.6	<0.001
Village Road	1.5	0.9–2.4	0.08

Table 5 presents logistic regression results. Children aged 10–14, male gender, and lack of safety measures were significant predictors of severe or fatal injuries.

Discussion

This cross-sectional study provides a comprehensive analysis of the incidence and patterns of road traffic accidents (RTAs) involving children in rural areas of Gazipur, Bangladesh. The findings underscore the urgent need for targeted interventions to enhance road safety for this vulnerable population.

The study revealed that the most affected age group was 10–14 years, accounting for 36.2% (n=105) of the cases. This aligns with previous research indicating that children in this age range are particularly at risk due to increased

independence and mobility[1,3,4]. Males comprised 58.6% (n=170) of the cases, which is consistent with global trends showing higher accident rates among male children[2]. Additionally, over half (51.7%, n=150) of the affected children came from low socio-economic backgrounds, highlighting the intersection of poverty and vulnerability in road safety incidents.

The analysis of accident circumstances revealed that 62.1% (n=180) of the accidents occurred on village roads, significantly higher than the 37.9% (n=110) recorded on rural highways (p < 0.05). This finding is critical as it indicates that rural infrastructure may be inadequate for the safe passage of children, a concern echoed in studies emphasizing the need for improved road conditions in rural settings[5-7]. Motorcycles were the most frequently involved vehicles, accounting for 41.4% (n=120) of accidents, followed by bicycles at 27.6% (n=80). This is consistent with findings from other studies indicating that two-wheeled vehicles are often implicated in child accidents, particularly in low- and middle-income countries[8]. Furthermore, the peak accident time was in the afternoon (44.8%, n=130), suggesting that increased traffic during school dismissal hours may contribute to higher accident rates.

Injury severity analysis indicated that moderate injuries were most common across all age groups, particularly in the 10–14 years age group (38.1%). Severe and fatal injuries were notably higher in the 15–18 age group, with rates of 33.3% and 16.7%, respectively. This pattern highlights the escalating risks as children transition into adolescence, a finding supported by previous studies that report increased severity of injuries in older children[9].

The study found alarmingly low rates of safety measure usage, with only 10.3% (n=30) of children using helmets and 5.2% (n=15) using seatbelts at the time of the accident. Furthermore, nearly 60% (n=170) of the children lacked adult supervision. These findings are concerning, as the absence of safety measures significantly elevates the risk of severe injuries. Previous research has demonstrated that the implementation of safety measures, such as helmet use, can reduce the severity of injuries in road traffic accidents[10,11,12].

The logistic regression analysis identified several significant predictors of severe or fatal injuries. Children aged 10–14 years had an odds ratio (OR) of 2.5 (95% CI: 1.4–4.5, p < 0.01), indicating a significantly higher risk compared to other age groups. Male gender also emerged as a significant factor (OR: 1.8, 95% CI: 1.1–3.0, p < 0.05). The lack of safety measures was the most substantial predictor, with an OR of 3.2 (95% CI: 1.8–5.6, p < 0.001), emphasizing the critical role that safety interventions can play in preventing severe injuries.

Conclusion

This study highlights the pressing need for enhanced road safety measures for children in rural Bangladesh. The high incidence of RTAs, particularly on village roads and involving motorcycles, necessitates urgent policy interventions. Strategies should focus on improving road infrastructure, enforcing safety regulations, and promoting awareness among parents and guardians regarding the importance of supervision and safety measures. Future research should explore the effectiveness of these interventions and their impact on reducing child injuries in road traffic accidents.

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Original Article

Exploring the Impact of Tobacco Use on Oral Hygiene Practices, Health-Seeking Behavior, and Awareness of Oral Cancer Among Adolescents in Rural Bangladesh: A Cross-Sectional Study

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Abstract

Background: *Tobacco use is a major public health issue globally, with significant adverse effects on oral health and increased risk of oral cancer.* ***Objective:*** *This study aims to explore the relationship between tobacco use, oral hygiene practices, health-seeking behavior, and awareness of oral cancer among adolescents in rural Bangladesh.* ***Methods:*** *A cross-sectional study was conducted in Baktarpur, Jamalpur Union, Kaliganj Upazila, Gazipur District, Bangladesh, from June to November 2024. A total of 300 adolescents (120 females, 180 males) aged over 30 years were surveyed. Data was collected through structured interviews using a pre-designed questionnaire.* ***Results:*** *The study found that 60% of participants used tobacco, with a significantly higher prevalence in males (83.3%) compared to females (25%). Tobacco use was associated with poorer oral hygiene practices, with 30.6% of tobacco users brushing their teeth less than once a day compared to 12.5% of non-users (p<0.01). Only 60% of participants were aware of oral cancer, and tobacco users had significantly lower awareness levels (50%) compared to non-users (75%) (p<0.05). Additionally, 40% of participants had never visited a dentist, with no significant differences between those aware and unaware of oral cancer.* ***Conclusion:*** *Tobacco use negatively impacts oral hygiene practices and awareness of oral cancer among adolescents in rural Bangladesh. The findings highlight the need for public health interventions aimed at raising awareness about oral cancer and improving access to dental care, particularly targeting tobacco users.*

Keywords: Tobacco use, Oral hygiene, Oral cancer awareness, Health-seeking behavior, Adolescents.

Introduction

In South-central Asia, the oral cavity and oropharynx are the most common sites for head and neck cancers, with oral squamous cell carcinoma (OSCC) constituting over 90% of these malignancies. These cancers often begin as inflammatory lesions, such as leukoplakia, erythroplakia,

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and erythroleukoplakia[1]. Notably, oral cancer is one of the few cancers whose survival rate has remained stagnant for over 30 years, with a documented 60% increase in cases among adults under the age of 40 over the past three decades. Oral cancer has become a significant public health concern, and early intervention remains critical[2]. In Bangladesh, tobacco use is widespread, and the majority of the population consumes tobacco in some form. Tobacco consumption, whether through smoking or smokeless tobacco, is a known risk factor for numerous oral conditions, ranging from gingivitis to oral cancers[3]. Smokeless tobacco, in particular, has been linked to a variety of oral diseases and is a significant contributor to oral cancer, especially in Asia, where betel nut chewing, combined with tobacco use, is prevalent. Oral cancer is the third most common cancer in Asia, largely due to these habits. However, despite the established risks, many in the

population remain unaware of the health hazards associated with tobacco use4. Several factors contribute to the high rates of tobacco use in Bangladesh, including poverty, illiteracy, ignorance, and the lack of adequate health education and proper supervision. The harmful chemicals found in tobacco products, especially in smoked tobacco, are well-documented for their carcinogenic properties. Smokeless tobacco products, when combined with betel nut, can lead to a variety of oral health issues, including staining of the teeth, decreased ability to taste and smell, and conditions like nicotinic stomatitis and keratosis. While many of these issues are reversible after cessation of tobacco use, the long-term effects, including oral cancer, are preventable through awareness and early intervention[3-5].

Research has shown a dose-response relationship between tobacco use and the risk of oral cancer, with the risk increasing as the duration and frequency of use rise. Smokers who also consume alcohol are at an even greater risk, with studies indicating a two to four-fold increased risk of developing oral cancer[6]. Tobacco chewing combined with betel nut consumption is also a major risk factor for the development of oral lesions, many of which can progress to oral cancer if left untreated. Oral cancer remains a preventable disease, and interventions focusing on cessation, early diagnosis of pre-malignant lesions, and better public awareness are crucial for reducing its burden[7]. In Bangladesh, oral cancer is the fifth most common cancer among men and the fourth among women. The high incidence of oral cancer in the Bangladeshi population reflects the persistent habits of tobacco and betel nut chewing, which remain common in both genders. While numerous studies have been conducted on oral health in countries like India and Pakistan, there is a gap in research focusing specifically on Bangladesh, particularly in rural areas where tobacco use is prevalent, and health awareness is often low[8,9]. The lack of detailed information on how tobacco use affects health-seeking behavior and awareness of oral cancer in this population hinders the development of effective public health interventions[10,11]. This study aims to address this gap by exploring the impact of tobacco use on oral hygiene practices, health-seeking behavior, and awareness of oral cancer among adolescents in rural Bangladesh, specifically in Baktarpur, Jamalpur Union, Kaliganj Upazila, Gazipur District. By examining these factors, the study seeks to provide evidence to inform targeted interventions to reduce tobacco use and improve oral health awareness in rural communities.

Methodology

The study titled "Exploring the Impact of Tobacco Use on Oral Hygiene Practices, Health-Seeking Behavior, and Awareness of Oral Cancer Among Adolescents in Rural Bangladesh: A Cross-Sectional Study" was conducted in Baktarpur and Jamalpur Union of Kaliganj Upazila, Gazipur District, Dhaka, between June and November 2024. The study aimed to assess the influence of tobacco use on oral hygiene practices, health-seeking behaviors, and the level of awareness regarding oral cancer among adolescents. A total of 300 participants were enrolled in the study, comprising 120 females and 180 males, all aged over 30 years. The participants were selected using a stratified random sampling technique to ensure representation from different demographic groups. Data collection was performed through structured interviews, administered by trained research assistants. The interviews used a combination of closed and open-ended questions to gather information on tobacco usage, oral hygiene habits, knowledge of oral cancer, and health-seeking behaviors. Additionally, oral examinations were conducted by qualified dental professionals to assess the condition of oral health among the participants. Consent was obtained from all participants before their inclusion in the study, with a clear explanation of the purpose of the research, procedures, and their right to confidentiality and voluntary participation. Ethical approval for the study was granted by the relevant institutional review board, ensuring adherence to ethical standards in human research.

Result
Table 1: Demographic Characteristics of Participants

Variable	Female n=120	Male n=180	Total n=300	(%)
Age Group (Years)				
31-40	45	55	100	33.3%
41-50	35	50	85	28.3%
51-60	25	40	65	21.7%
61+	15	35	50	16.7%
Socioeconomic Status				
Low	40	60	100	33.3%
Middle	50	70	120	40.0%
High	30	50	80	26.7%

Table 1 shows the demographic characteristics of the study participants. The sample consists of 120 females and 180 males. The majority of participants belong to the middle socioeconomic status group (40%), followed by the low (33.3%) and high (26.7%) status categories. The age groups are fairly distributed, with 33.3% in the 31-40 years category.

Table 2: Tobacco Use Among Participants

Variable	Female n=120	Male n=180	Total n=300	%
Ever Used Tobacco	30	150	180	60.0%
Never Used Tobacco	90	30	120	40.0%
Type of Tobacco Used				
Cigarettes	10	100	110	61.1%
Smokeless Tobacco	15	40	55	30.6%
Both	5	10	15	8.3%

Table 2 presents the tobacco use patterns among participants. 60% of participants reported using tobacco, with males (83.3%) having a significantly higher rate of usage compared to females (25%). Among tobacco users, the most common form is cigarettes (61.1%), followed by smokeless tobacco (30.6%).

Table 3: Oral Hygiene Practices Among Participants

Variable	Female n=120	Male n=180	Total n=300	%
Frequency of Brushing				
Once Daily	50	60	110	36.7%
Twice or More Daily	40	70	110	36.7%
Irregular	30	50	80	26.7%
Use of Toothpaste				
Yes	100	150	250	83.3%
No	20	30	50	16.7%

Table 3 shows 36.7% of participants brush their teeth once daily, while another 36.7% brush twice or more daily. Approximately 16.7% brush less than once daily. Most participants (83.3%) use toothpaste for oral hygiene.

Table 4: Awareness of Oral Cancer

Variable	Female n=120	Male n=180	Total n=300	%
Heard of Oral Cancer	60	120	180	60.0%
No Awareness of Oral Cancer	60	60	120	40.0%
Sources of Awareness				
Media	30	70	100	33.3%
Healthcare Providers	20	40	60	20.0%
Family/Friends	10	10	20	6.7%
No Awareness Source	60	60	120	40.0%

Table 4 presents awareness of oral cancer among participants. 60% of participants have heard of oral cancer, with the highest proportion gaining awareness through media (33.3%). Interestingly, 40% of participants had no awareness of oral cancer.

Table 5: Health-Seeking Behavior Related to Oral Health

Variable	Female n=120	Male n=180	Total n=300	%
Visit to a Dentist	40	80	120	40.0%
Never Visited a Dentist	80	100	180	60.0%
Frequency of Visits (If visited)				
Once a Year	15	30	45	15.0%
Twice or More a Year	10	20	30	10.0%
Only When Sick	15	30	45	15.0%

Table 5 examines health-seeking behavior related to oral health. Only 40% of participants have visited a dentist, with a larger proportion (60%) having never visited. Among those who have visited, the most common frequency is once a year (15%).

Table 6: Tobacco Use and Oral Hygiene Practices

Variable	Use Tobacco (n=180)	Do Not Use Tobacco (n=120)	p-value
Brushing Once Daily	45 (25%)	65 (54.2%)	<0.01
Brushing Twice or More Daily	80 (44.4%)	40 (33.3%)	0.03
Less Than Once Daily	55 (30.6%)	15 (12.5%)	<0.01
Use of Toothpaste	150 (83.3%)	100 (83.3%)	1.00

Table 6 explores the relationship between tobacco use and oral hygiene practices. The results show a significant association between tobacco use and poorer oral hygiene practices. Tobacco users are more likely to brush less frequently (30.6%) and less likely to brush twice or more daily (44.4%) compared to non-users. The p-value for brushing frequency was statistically significant.

Table 7: Tobacco Use and Awareness of Oral Cancer

Variable	Use Tobacco (n=180) (n=120)	Do Not Use Tobacco	p-value
Heard of Oral Cancer	90 (50%)	90 (75%)	<0.01
No Awareness of Oral Cancer	90 (50%)	30 (25%)	<0.01

Table 7 shows the relationship between tobacco use and awareness of oral cancer. The table reveals that tobacco users have significantly lower awareness of oral cancer compared to non-users, with 50% of tobacco users having no awareness compared to 25% among non-users (p<0.01).

Table 8: Health-Seeking Behavior and Awareness of Oral Cancer

Variable	Aware of Oral Cancer (n=180)	Not Aware of Oral Cancer (n=120)	p-value
Visit to a Dentist	70 (38.9%)	50 (41.7%)	0.42
Never Visited a Dentist	110 (61.1%)	70 (58.3%)	0.42

Table 8 examines the relationship between health-seeking behavior and awareness of oral cancer. The analysis shows no significant difference in dental visit behavior between those who are aware and those unaware of oral cancer (p=0.

Discussion

This study explored the impact of tobacco use on oral hygiene practices, health-seeking behavior, and awareness of oral cancer among adolescents in rural Bangladesh. The findings reveal critical insights into how tobacco consumption influences oral health behaviors and awareness of oral cancer, providing important implications for public health interventions in rural communities.

The study found that 60% of participants reported using tobacco, with significantly higher usage among males (83.3%) compared to females (25%). This aligns with findings from other studies in Bangladesh, which reported a higher prevalence of tobacco use among men in rural settings[13]. The predominant types of tobacco use were cigarettes (61.1%) and smokeless tobacco (30.6%), consistent with the national trends observed in studies by Hossain et al. (2017), where cigarettes and smokeless tobacco were the most commonly used forms in rural areas[14].

In terms of oral hygiene, 36.7% of participants brushed their teeth once daily, and another 36.7% brushed twice or more daily, while 26.7% brushed less than once a day. Tobacco users were more likely to brush less frequently, with 30.6% of tobacco users brushing less than once a day compared to 12.5% of non-users. This finding is supported by research conducted by Amarasena et al. (2002), which indicates that tobacco users tend to neglect oral hygiene practices, leading to a higher risk of dental problems such as gum disease and tooth decay[15]. Furthermore, a significant association was observed between tobacco use and poorer oral hygiene practices (p<0.01), indicating that tobacco consumption negatively impacts oral health habits, as confirmed by previous studies[16].

Regarding awareness of oral cancer, 60% of participants had heard of oral cancer, with the majority of them learning about it from media sources (33.3%). However, a significant 40% of participants had no awareness of oral cancer. The awareness levels were much lower among tobacco users, with only 50% of tobacco users aware of oral cancer compared to 75% of non-users. This suggests that tobacco use is inversely related to awareness of oral cancer, as tobacco consumption is a major risk factor for oral cancer, yet users appear to have lower awareness about its potential consequences.

Studies by Chowdhury et al. (2024) and Mubin et al. (2021) also highlight the low levels of oral cancer awareness in rural Bangladesh, particularly among tobacco users. These findings suggest a need for public health campaigns to raise awareness about the risks of oral cancer, especially targeting tobacco users in rural communities. The media, which was the primary source of awareness

in this study, should be leveraged more extensively to disseminate information about oral cancer prevention and the harmful effects of tobacco[17,18]. The study also assessed health-seeking behavior related to oral health. Only 40% of participants had ever visited a dentist, and 60% had never visited a dentist. Among those who visited a dentist, most did so only when they were sick (15%). This is a concerning finding, as it indicates that many rural adolescents do not engage in preventive oral healthcare, potentially due to limited access to dental services. Similar findings were reported by Mostarin et al. (2019), who noted that in rural Bangladesh, there is limited access to dental care, which contributes to low dental visit rates[19].

The study found that health-seeking behavior was not significantly different between those who were aware of oral cancer and those who were not. This suggests that awareness of oral cancer does not necessarily translate into improved health-seeking behavior, which aligns with findings from studies such as Kabir et al. (2022), who emphasized the need for more effective strategies to translate health awareness into action, particularly in rural areas where healthcare infrastructure is limited[20].

The study also examined the sociodemographic factors influencing tobacco use, oral hygiene practices, and health-seeking behavior. The majority of participants (40%) were from the middle socioeconomic class, followed by 33.3% from the low class and 26.7% from the high class. Although socioeconomic status did not show a direct influence on tobacco use or awareness of oral cancer, it is important to note that individuals from lower s

ocioeconomic backgrounds often have limited access to healthcare services, including dental care. This barrier to accessing healthcare is a critical factor contributing to poorer health outcomes, as reported by Hossain et al. (2023), who found that lower socioeconomic status is strongly associated with reduced access to healthcare in rural Bangladesh21. The findings also underscore the gender differences in tobacco use, with males having a significantly higher prevalence of tobacco consumption than females, as previously mentioned. This gender disparity is consistent with global studies, such as those by Jamison (2013), which highlight that tobacco use is generally higher among males in many developing countries, including Bangladesh[22].

Conclusion

In conclusion, this study highlights the significant impact of tobacco use on oral hygiene practices, health-seeking behavior, and awareness of oral cancer among adolescents in rural Bangladesh. The findings suggest that tobacco use is associated with poorer oral hygiene and lower awareness of oral cancer, emphasizing the need for targeted public health interventions. Specifically, awareness campaigns about the dangers of tobacco and oral cancer should be integrated into media channels and healthcare programs, with a focus on educating tobacco users. Additionally, improving access to dental care in rural areas is essential to address the oral health needs of the population. Future research should explore interventions aimed at increasing both tobacco cessation and preventive healthcare practices, particularly in underserved rural communities.

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Original Article

Trends in Neonatal Respiratory Distress:
A Cross-Sectional Study in Urban vs. Rural Settings

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Abstract

Background: *Neonatal respiratory distress (NRD) is a major cause of neonatal morbidity and mortality, particularly in low- and middle-income countries. This condition is influenced by various factors such as preterm birth, intrauterine growth restriction (IUGR), infections, and access to neonatal care.* ***Objective:*** *This study aimed to assess the prevalence, risk factors, and outcomes of neonatal respiratory distress in urban and rural settings of Chattogram, Bangladesh, and to compare these factors between neonates from urban and rural areas.* ***Methods:*** *A cross-sectional study was conducted from January to December 2023, involving 120 neonates, from the NICUs of Chattogram Medical College Hospital and BGC Trust Medical College Hospital. Data were collected using structured questionnaires, clinical assessments, and routine neonatal evaluations.* ***Results:*** *The prevalence of NRD was significantly higher in rural neonates (30%) compared to urban neonates (16.7%). Major contributing factors included prematurity (p=0.04), intrauterine growth restriction (IUGR) (p=0.001), and sepsis (p=0.05). The use of antenatal corticosteroids was more prevalent in urban settings (30% vs. 16.7%, p=0.093). Rural neonates had a longer NICU stay (mean 9.3 days) compared to urban neonates (mean 7.5 days, p=0.045).* ***Conclusion:*** *This study highlights a higher prevalence of neonatal respiratory distress in rural settings, attributed to limited access to prenatal and neonatal care, socioeconomic disparities, and higher rates of IUGR and sepsis. Enhancing antenatal care and improving neonatal services in rural areas could significantly reduce the burden of NRD.*

Introduction

Neonatal respiratory distress (NRD) is a significant concern for newborns worldwide and is a leading cause of neonatal morbidity and mortality. This condition typically appears within the first few hours to days after birth, characterized by difficulty breathing, rapid respiration, and, in severe cases, cyanosis. It is linked to various underlying causes, including immature lung development, infections, mechanical obstructions, and other systemic factors. While neonatal respiratory distress can be effectively managed with timely interventions, especially in well-equipped settings, it remains a major challenge in resource-limited areas, particularly in rural regions where access to advanced neonatal care is often restricted. The pathophysiology of NRD is complex, with a range of underlying causes contributing to the condition. In premature infants, the most common cause of respiratory distress is respiratory distress syndrome (RDS), which results from surfactant deficiency. Surfactant is crucial for reducing surface tension in the lungs, and its absence in premature infants leads to collapsed alveoli, impaired gas exchange, and difficulty breathing. Other common causes of NRD

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include Transient Tachypnea of the Newborn (TTN), Meconium Aspiration Syndrome (MAS), and infections such as pneumonia or sepsis. While these conditions can affect any neonate, preterm and low-birth-weight infants are particularly susceptible to respiratory distress due to their underdeveloped lungs and other physiological limitations[5,6]. In high-income countries, advanced neonatal care, including the use of mechanical ventilation, continuous positive airway pressure (CPAP), and surfactant replacement therapy, has significantly reduced mortality and morbidity associated with NRD. However, in low- and middle-income countries (LMICs), especially in rural areas, the burden of neonatal respiratory distress remains disproportionately high[7]. In many rural settings, limited access to specialized care, inadequate infrastructure, and delays in diagnosis and treatment contribute to worse outcomes. Neonatal care in these regions often faces challenges such as shortages of trained healthcare personnel, limited access to neonatal intensive care units (NICUs), and a lack of essential medical equipment like oxygen therapy units and ventilators. As a result, neonates in these areas are at higher risk of mortality and long-term complications[8,9]. The rural-urban disparity in the prevalence and outcomes of neonatal respiratory distress has been well-documented in many countries. Urban areas typically have better healthcare infrastructure, more trained healthcare providers, and improved access to neonatal intensive care, leading to lower mortality rates and better management of respiratory distress. In contrast, rural regions often face challenges related to access to healthcare services, including fewer trained professionals, a lack of specialized care facilities, and delays in receiving adequate treatment. This difference in healthcare availability contributes to higher rates of NRD-related morbidity and mortality in rural areas[10,11]. This study aims to explore the trends in neonatal respiratory distress by comparing the prevalence, causes, and outcomes of NRD in urban and rural settings in Bangladesh. The study will specifically focus on the differences in the occurrence and management of NRD in neonates admitted to the neonatal intensive care units (NICUs) of Chittagong Medical College and BGC Trust Medical College (urban), and those treated in the rural Upazila health complexes of Mirsharai, Shitakundo, and Patia. By examining the trends in NRD across these settings, this research seeks to identify key factors contributing to the burden of neonatal respiratory distress and highlight the differences in access to and quality of care between urban and rural areas. Methodology

Methodology

This cross-sectional study was conducted to compare trends in neonatal respiratory distress between urban and rural settings in Chattogram, Bangladesh. Data collection took place over one year, from January to December 2023. A total of 120 neonates diagnosed with respiratory distress were included in the study. The urban cohort consisted of 60 neonates residing in Chattogram City, while the rural cohort comprised 60 neonates from Mirsharai, Shitakundo, Patia, and other Upazilas of the Chattogram District. Both urban and rural neonates were admitted to the Neonatal Intensive Care Units (NICUs) at Chattogram Medical College Hospital and BGC Trust Medical College Hospital. Data were collected through a combination of medical record reviews and structured interviews with the neonates' caregivers. Informed consent was obtained from parents or legal guardians by ethical standards. A structured questionnaire was used to gather demographic information, maternal health history, birth characteristics, and clinical details related to respiratory distress. Variables assessed included gestational age, birth weight, mode of delivery, Apgar scores, and family socioeconomic status. The primary tools for data collection included clinical diagnostic records, laboratory reports, and physical assessments performed by neonatologists. Respiratory distress was diagnosed based on clinical signs such as tachypnea, grunting, nasal flaring, and retractions, alongside chest X-rays, blood gas analysis, and oxygen saturation levels. To ensure data accuracy, a standardized protocol was followed for recording clinical outcomes. All collected data were entered into a database and analyzed using statistical software. Descriptive statistics were applied to compare the prevalence, severity, and risk factors associated with neonatal respiratory distress between urban and rural settings.

Result

Table 1: Demographic Characteristics of Neonates with Respiratory Distress

Variable	Urban n=60	Rural n=60	Total N=120	p-value
Mean Birth Weight (g)	2650 ± 450	2450 ± 380	2550 ± 420	0.015
Gestational Age (weeks)	38.2 ± 1.4	37.5 ± 1.6	37.9 ± 1.5	0.031
Male (%)	34 (56.7%)	31 (51.7%)	65 (54.2%)	0.614
Female (%)	26 (43.3%)	29 (48.3%)	55 (45.8%)	0.614
Low Birth Weight (%)	12 (20%)	18 (30%)	30 (25%)	0.207
Preterm (<37 weeks) (%)	10 (16.7%)	16 (26.7%)	26 (21.7%)	0.204

Table 1 shows the demographic characteristics of neonates with respiratory distress. Neonates from urban areas had a significantly higher mean birth weight (p=0.015) and gestational age (p=0.031) compared to those from rural areas. However, no statistically significant difference was observed in terms of gender distribution, low birth weight, or preterm birth status.

Table 2: Maternal Risk Factors Associated with Neonatal Respiratory Distress

Risk Factor	Urban n=60	Rural n=60	Total N=120	p-value
Maternal Age (>35 years)	10 (16.7%)	18 (30%)	28 (23.3%)	0.116
Gestational Diabetes	8 (13.3%)	4 (6.7%)	12 (10%)	0.223
Maternal Hypertension	15 (25%)	19 (31.7%)	34 (28.3%)	0.416
Infections during Pregnancy	5 (8.3%)	9 (15%)	14 (11.7%)	0.255
Antenatal Care (Inadequate)	9 (15%)	24 (40%)	33 (27.5%)	0.003

Table 2 highlights the maternal risk factors associated with neonatal respiratory distress. Notably, a significantly

higher proportion of mothers from rural areas received inadequate antenatal care compared to urban areas (40% vs. 15%, p=0.003). Other risk factors, such as maternal age, hypertension, and infections, did not show significant differences between the two groups.

Table 3: Mode of Delivery and Associated Neonatal Outcomes

Mode of Delivery	Urban n=60	Rural n=60	Total N=120	p-value
Vaginal Delivery	35 (58.3%)	40 (66.7%)	75 (62.5%)	0.350
Cesarean Section	25 (41.7%)	20 (33.3%)	45 (37.5%)	0.350
Apgar Score <7 at 5 min	12 (20%)	22 (36.7%)	34 (28.3%)	0.049
NICU Admission	25 (41.7%)	34 (56.7%)	59 (49.2%)	0.108

Table 3 examines the mode of delivery and neonatal outcomes. A significantly higher proportion of neonates from rural areas had Apgar scores of less than 7 at 5 minutes compared to those from urban areas (36.7% vs. 20%, p=0.049). NICU admission rates were higher in rural areas, though this difference was not statistically significant.

Table 4: Clinical Presentation of Neonatal Respiratory Distress

Clinical Signs	Urban n=60	Rural n=60	Total N=120	p-value
Tachypnea	40 (66.7%)	47 (78.3%)	87 (72.5%)	0.155
Grunting	22 (36.7%)	35 (58.3%)	57 (47.5%)	0.018
Nasal Flaring	30 (50%)	33 (55%)	63 (52.5%)	0.585
Cyanosis	10 (16.7%)	15 (25%)	25 (20.8%)	0.276
Retractions	28 (46.7%)	40 (66.7%)	68 (56.7%)	0.035

Table 4 illustrates the clinical presentation of neonatal respiratory distress. Grunting (p=0.018) and retractions (p=0.035) were significantly more common among rural neonates compared to urban neonates. Tachypnea and nasal flaring were prevalent in both groups, though no significant differences were noted.

Table 5: Treatment and Outcomes of Neonatal Respiratory Distress

Treatment	Urban n=60	Rural n=60	Total N=120	p-value
Phototherapy	18 (30%)	24 (40%)	42 (35%)	0.245
Mechanical Ventilation	12 (20%)	22 (36.7%)	34 (28.3%)	0.049
Survival	55 (91.7%)	48 (80%)	103 (85.8%)	0.065
Mortality	5 (8.3%)	12 (20%)	17 (14.2%)	0.065

Table 5 shows the treatment and outcomes of neonatal respiratory distress. Mechanical ventilation was required significantly more often in rural neonates (p=0.049). While mortality rates were higher in rural areas (20% vs. 8.3%), this difference approached but did not reach statistical significance (p=0.065).

Table 6: Neonatal Risk Factors

Risk Factor	Urban n=60	Rural n=60	Total N=120	p-value
Intrauterine Growth Restriction (%)	5 (8.3%)	12 (20%)	17 (14.2%)	0.081
Sepsis (%)	8 (13.3%)	14 (23.3%)	22 (18.3%)	0.179
Respiratory Distress Syndrome (%)	10 (16.7%)	18 (30%)	28 (23.3%)	0.090

Table 6 examines neonatal risk factors like intrauterine growth restriction (IUGR), sepsis, and respiratory distress syndrome (RDS). A higher proportion of rural neonates experienced IUGR and RDS compared to their urban counterparts.

Table 7: Maternal Medical History

Medical History	Urban n=60	Rural n=60	Total N=120	p-value
Anemia (%)	20 (33.3%)	30 (50%)	50 (41.7%)	0.060
Smoking during Pregnancy (%)	3 (5%)	10 (16.7%)	13 (10.8%)	0.047
Previous Preterm Births (%)	6 (10%)	12 (20%)	18 (15%)	0.145

Table 7 presents maternal medical history. Anemia was observed more frequently in rural mothers (50%) compared to urban (33.3%). Smoking during pregnancy was also significantly higher in rural mothers (p=0.047).

Table 8: Socioeconomic Status of Mothers

Socioeconomic Variable	Urban n=60	Rural n=60	Total N=120	p-value
Low Household Income (%)	15 (25%)	35 (58.3%)	50 (41.7%)	<0.001
Maternal Education (<SSC) (%)	20 (33.3%)	40 (66.7%)	60 (50%)	<0.001
Living Conditions (Poor) (%)	12 (20%)	30 (50%)	42 (35%)	0.001

Table 8 illustrates the socioeconomic status of mothers. Rural mothers had a significantly lower household income compared to urban mothers (58.3% vs. 25%, p<0.001). Additionally, a greater proportion of rural mothers had not completed secondary school (66.7% vs. 33.3%, p<0.001), and rural mothers were more likely to live in poor housing conditions (50% vs. 20%, p=0.001). These socioeconomic disparities likely contribute to the higher rates of neonatal respiratory distress (NRD) observed in rural areas.

Table 9: Antenatal Corticosteroid Use

Antenatal Corticosteroid Use	Urban n=60	Rural n=60	Total N=120	p-value
Received (%)	18 (30%)	10 (16.7%)	28 (23.3%)	0.093
Not Received (%)	42 (70%)	50 (83.3%)	92 (76.7%)	0.093

Table 9 shows the use of antenatal corticosteroids for fetal lung maturation. A slightly higher percentage of urban mothers received corticosteroids compared to rural mothers, though this difference was not statistically significant.

Table 10: NICU Length of Stay

Length of Stay (days)	Urban n=60	Rural n=60	Total N=120	p-value
Mean (±SD)	7.5 ± 2.4	9.3 ± 3.1	8.4 ± 2.9	0.008
< 7 days (%)	30 (50%)	18 (30%)	48 (40%)	0.025
≥ 7 days (%)	30 (50%)	42 (70%)	72 (60%)	0.025

Table 10 highlights the length of stay in the NICU.

Rural neonates had a significantly longer mean stay compared to urban neonates (p=0.008), with 70% of rural neonates staying for 7 days or more, compared to 50% of urban neonates (p=0.025).

Discussion

Neonatal respiratory distress is a significant health concern with both short- and long-term consequences. The findings from our study show important differences in the prevalence and contributing factors between urban and rural neonates, which are in line with findings from other studies in similar settings. Our study found that respiratory distress syndrome (RDS) affected 16.7% of urban neonates and 30% of rural neonates, which is statistically significant (p=0.090). This is consistent with studies in low-income settings, such as those conducted in sub-Saharan Africa, where neonatal respiratory distress was found to be prevalent due to factors such as prematurity and limited access to prenatal care and skilled birth attendants[12]. The higher percentage of RDS in rural neonates suggests that access to neonatal care and early interventions such as antenatal corticosteroid administration may be less available in rural settings, thus contributing to poorer outcomes. Table 6 revealed a higher incidence of intrauterine growth restriction (IUGR) among rural neonates (20%) compared to urban neonates (8.3%). This finding is aligned with global studies that report higher rates of IUGR in rural populations, often due to malnutrition, poor antenatal care, and limited access to health services[13,14]. Sepsis also showed a higher prevalence in rural neonates (23.3%) than in urban ones (13.3%), which may be attributed to delayed healthcare access and inadequate neonatal care in rural settings, where infections are often poorly managed due to limited resources[15,16]. Socioeconomic status was a major determinant in our study. The proportion of mothers with low household income was significantly higher in rural areas (58.3% vs. 25%), which is consistent with research highlighting the influence of poverty on neonatal health outcomes. Poverty in rural settings limits access to healthcare, prenatal care, and proper nutrition, leading to poorer neonatal health[17,18]. Furthermore, maternal education was significantly lower in rural populations (66.7% of rural mothers had less than SSC-level education compared to 33.3% of urban mothers), which correlates with poor knowledge and practices related to newborn care and respiratory distress[2]. Antenatal corticosteroid use, which helps in fetal lung maturation, was higher in urban settings (30%) compared to rural (16.7%), showing a significant difference (p=0.093). This suggests that urban mothers have better access to healthcare services, including antenatal corticosteroid administration, which is a crucial intervention for preventing respiratory distress syndrome in preterm neonates[19]. The length of stay in the NICU was significantly longer for rural neonates (mean = 9.3 ± 3.1 days) compared to urban neonates (mean = 7.5 ± 2.4 days), with 70% of rural neonates requiring more than 7 days of care. This longer duration of NICU stay in rural settings highlights the delayed presentation and possibly the severity of the condition in these neonates. Rural health systems are often overwhelmed with cases and face challenges like inadequate staffing, which contributes to longer recovery times[5].

Conclusion

In conclusion, our study shows that neonatal respiratory distress is more prevalent in rural settings compared to urban areas, with rural neonates experiencing higher rates of respiratory distress, intrauterine growth restriction, and sepsis. The differences in neonatal outcomes are likely influenced by socioeconomic factors, maternal health, and access to prenatal and neonatal care. The study underscores the importance of improving antenatal and neonatal care in rural areas, including better access to prenatal corticosteroids, better maternal education, and improved infection control. Addressing these disparities can significantly reduce neonatal morbidity and mortality in these vulnerable populations.

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Original Article

Synergistic Effects of Antibiotic Combinations Against Multidrug-Resistant Morganella morganii: An In Vitro and In Vivo Study

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Abstract

Background: *Morganella morganii, an opportunistic Gram-negative bacterium, is emerging as a significant cause of nosocomial infections, particularly urinary tract infections (UTIs), bacteremia, and sepsis. This pathogen's resistance to multiple antibiotics, including third-generation cephalosporins, is largely attributed to the production of AmpC β-lactamase and extended-spectrum β-lactamases (ESBLs). The rising prevalence of multidrug-resistant (MDR) strains of M. morganii presents a major challenge in treating infections.* **Objective:** *To explore the synergistic effects of antibiotic combinations against MDR M. morganii using both in vitro and in vivo models and identify the most effective combinations to combat resistance.* **Methods:** *A total of 353 clinical samples (urine, wound swabs, and pus) were collected from patients with suspected infections at Dhaka Medical College Hospital. Antibiotic resistance profiles were determined using the Kirby-Bauer disk diffusion method. The synergistic effects of antibiotic combinations—ceftazidime, imipenem, and amikacin—were evaluated in vitro using the agar dilution method and in vivo through a murine bloodstream infection model.* **Results:** *Among the 7 isolated M. morganii strains, 57.14% were MDR, and 14.29% were extensively drug-resistant (XDR). In vitro testing revealed significant synergy between ceftazidime and amikacin, imipenem and amikacin, and ceftazidime and imipenem, as indicated by FICI values ≤0.5. In vivo, antibiotic combinations, particularly amikacin + imipenem and ceftazidime + amikacin, showed enhanced bacterial clearance from blood cultures compared to single antibiotics. Conclusion: Antibiotic combination therapy, particularly the pairing of ceftazidime with amikacin or imipenem, demonstrates promising results in overcoming the resistance of MDR M. morganii. These findings support the development of combination-based treatment strategies to address the growing threat of MDR infections.*

Keywords: *Morganella morganii, multidrug-resistant, antibiotic resistance, synergistic effect, ceftazidime, amikacin, imipenem, nosocomial infections.*

Introduction

Morganella morganii, a Gram-negative bacterium in the Enterobacteriaceae family, is an opportunistic pathogen commonly found in the gastrointestinal tracts of humans

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and animals, as well as in environmental settings[1]. Despite its ubiquitous presence, M. morganii is emerging as a significant cause of nosocomial infections, particularly urinary tract infections (UTIs), bacteremia, and sepsis, which can result in high morbidity and mortality[2]. This bacterium is motile, non-lactose fermenting, and exhibits characteristics similar to Proteus species, such as urease production and phenylalanine deaminase activity[3]. M. morganii is primarily associated with hospital-acquired infections, entering the body through multiple routes, including the urinary tract, skin, hepatobiliary tract, soft tissues, and bloodstream[3]. The virulence of M. morganii is attributed to various factors, including fimbrial adhesins, lipopolysaccharides, IgA protease, and ureases, which enable the pathogen to adhere to host tissues and evade

immune responses[4]. One of the critical mechanisms driving the pathogenicity of M. morganii is its ability to produce AmpC β-lactamase, encoded by the blaAmpC gene, which confers resistance to several antibiotics, including cephalosporins and penicillins[5]. The emergence of M. morganii as a "superbug" has been linked to the widespread production of AmpC β-lactamase, rendering it resistant to third-generation cephalosporins like cefotaxime, ceftazidime, and ceftriaxone[6]. This resistance is not only induced by exposure to antibiotics but can also become stable due to specific mutations, further complicating treatment options[7,8]. Moreover, M. morganii often carries plasmids and class 1 integrons that harbor various resistance genes, including those for beta-lactamase and carbapenemase enzymes like TEM, CTX-M, KPC, and NDM9. The presence of extended-spectrum beta-lactamases (ESBLs), such as TEM-1 and SHV-1, further exacerbates the challenges in treating infections caused by M. morganii[10]. The global rise of multidrug-resistant (MDR) M. morganii is a significant public health concern, as these strains are not only resistant to multiple classes of antibiotics but also capable of forming biofilms on medical devices, such as urinary catheters, which increases the risk of infection, especially in catheter-associated urinary tract infections (CAUTIs)[11,12]. The urease activity of M. morganii contributes to biofilm formation, enhancing its persistence and resistance in the urinary tract, while the degradation of D-serine aids in its survival during CAUTIs[13,14]. As MDR M. morganii continues to spread globally, novel therapeutic strategies, such as antibiotic combination therapies, are becoming essential in overcoming treatment failures and managing resistance[15,16].

In this study, we aim to explore the synergistic effects of antibiotic combinations against MDR M. morganii using both in vitro and in vivo models. By characterizing the antimicrobial resistance patterns of M. morganii and identifying the presence of critical resistance genes like blaCTX-M and blaTEM in ESBL-producing isolates, we seek to provide valuable insights into the evolving landscape of M. morganii resistance. The findings will help inform the development of more effective treatment strategies, ultimately contributing to the global effort to combat antibiotic resistance.

Methodology

The study was conducted at the Department of Microbiology, Dhaka Medical College, from November 2022 to June 2023. A sample size of 353 was calculated based on an estimated infection prevalence. Samples, including urine, wound swabs, and pus, were collected from patients admitted to Dhaka Medical College Hospital with clinically suspected infections. Participants were selected regardless of sex or previous antibiotic use, provided they gave informed written consent. Patients who declined consent were excluded from the study. Demographic data, hospital stay duration, and laboratory findings were documented using a structured data collection sheet. Sample collection adhered to strict aseptic techniques: wound and pus samples were obtained using sterile swabs, and midstream clean-catch urine samples were collected. All samples were immediately transported to the laboratory for further analysis.

This study aimed to investigate the synergistic effects of antibiotic combinations against multidrug-resistant (MDR) Morganella morganii using both in vitro and in vivo approaches. The bacterial strains of M. morganii were isolated from clinical samples and identified through standard microbiological techniques, including Gram staining and biochemical tests. The antibiotic resistance profiles of the isolates were determined using the Kirby-Bauer disk diffusion method, and the strains were categorized into MDR, extensively drug-resistant (XDR), and pandrug-resistant (PDR) categories.

The in vitro efficacy of antibiotic combinations was evaluated using the agar dilution method. Combinations of ceftazidime, imipenem, and amikacin were tested against MDR M. morganii. The minimum inhibitory concentrations (MICs) for each antibiotic, both individually and in combination, were recorded. The synergistic effect of each combination was assessed using the Fractional Inhibitory Concentration Index (FICI) formula. A FICI value of ≤0.5 indicated synergism, a value of 1 indicated an additive effect, and values >1 were considered antagonistic. For the in vivo assessment, M. morganii was introduced into the bloodstream of Swiss albino mice, and antibiotic treatments were administered. The mice were divided into several groups: a positive control, a negative control, and treatment groups receiving amikacin, imipenem,

ceftazidime, or combinations of these antibiotics. Blood cultures were taken at regular intervals to monitor bacterial clearance from the bloodstream. The results were recorded as either blood culture positive or negative, and the percentage of culture-negative mice in each group was noted. Statistical analysis was conducted to compare the efficacy of different antibiotic combinations in both in vitro and in vivo settings. The synergy of each combination was expressed as the percentage of mice showing a reduction in bacterial load in the blood culture. The data from both the in vitro and in vivo experiments were analyzed and compared to identify the most effective combination for combating MDR M. morganii. The study was designed to explore the potential of antibiotic combinations in overcoming resistance mechanisms and to provide insights into developing more effective treatment strategies against MDR infections.

Result

Table 1: Types of antibiotic resistance patterns among the isolated Morganella morganii (N = 7)

Types of resistance	Number n (%)
MDR	4 (57.14)
XDR	1 (14.29)
PDR	0 (00.00)

N = Total number of isolated M. morganii.

n = Number of M. morganii identified as MDR, XDR, PDR.

Table 1 Shows different types of drug resistance pattern of the isolated Morganella morganii. Among 7 M. morganii, 4 (57.14%) were MDR, one (14.29%) was XDR and no PDR was detected.

Table 2: Efficacy of ceftazidime and imipenem combination against MDR Morganella morganii identified by agar dilution method (N=4).

Reduction MIC	Number (%)
8-fold reduction	1 (25.00)
4-fold reduction	1 (25.00)
2-fold reduction	2 (50.00)
At the MIC	0 (00.00)

Table 2 Shows efficacy of ceftazidime and imipenem combinations against MDR Morganella morganii identified by agar dilution method. Out of 4 ceftazidime and imipenem resistant M. morganii, one (25%) had 8-fold reduction of MIC, one (25%) had 4-fold reduction of MIC and 2 (50%) had 2- fold reduction of MIC.

Table 3: Efficacy of ceftazidime and amikacin combination against MDR Morganella morganii identified by agar dilution method (N=4).

Reduction MIC	Number (%)
8-fold reduction	2 (50.00)
4-fold reduction	1 (25.00)
2-fold reduction	1 (25.00)
At the MIC	0 (0.00)

Table 3 shows the efficacy of ceftazidime and amikacin combinations against MDR Morganella morganii identified by the agar dilution method. Out of 4 ceftazidime and amikacin-resistant M. morganii, 2 (50%) had an 8-fold reduction of MIC, one (25%) had a 4-fold reduction of MIC, and one (25%) had a 2-fold reduction of MIC.

Table 4: Efficacy of imipenem and amikacin combination against MDR Morganella morganii identified by agar dilution method (N=4).

Reduction MIC	Number (%)
8-fold reduction	2 (50.00)
4-fold reduction	1 (25.00)
2-fold reduction	1 (25.00)
At the MIC	0 (00.00)

Table 4 shows the efficacy of imipenem and amikacin combinations against MDR Morganella morganii identified by agar dilution method. Out of 4 imipenem and amikacin-resistant M. morganii, 2 (50%) had 8-fold reduction of MIC, one (25%) had a 4-fold reduction of MIC and one (25%) had 2- fold reduction of MIC.

Table 5: Results of antibiotic therapy on the clearance of MDR Morganella morganii from the blood of mouse (N=5).

Group	Blood culture positive n (%)	Blood culture negative n (%)
Positive Control	5 (100.00)	0 (0.00)
Negative Control	0 (0.00)	5 (100.00)
Only Amikacin	3 (60.00)	2 (40.00)
Only Imipenem	3 (60.00)	2 (40.00)
Only Ceftazidime	4 (80.00)	1 (20.00)
Amikacin + Imipenem	1 (20.00)	4 (80.00)
Ceftazidime + Imipenem	2 (40.00)	3 (60.00)
Ceftazidime + Amikacin	1 (20.00)	4 (80.00)

N=Number of mice in each group

n=number of mice became blood culture positive or blood culture negative.

Table 5 shows the result of antibiotic therapy on the clearance of MDR M. morganii from the blood among different groups of mice. In the positive control group, 100% were bacteremic. All the mice in the negative control group were blood culture negative. In the group treated with only amikacin and in the group treated with only imipenem, 40% were culture-negative. In the group treated with only ceftazidime, 20% were culture-negative. In the group treated with amikacin and imipenem, 80% were culture-negative. In the group treated with ceftazidime and amikacin, 80% were culture-negative. In the group treated with ceftazidime and imipenem, 60% were culture-negative.

Table 6: Comparison of synergism among different antibiotic combinations on MDR Morganella morganii in vitro and in vivo.

Combination group	Synergy in vitro %	Synergy in vivo %
Ceftazidime + Imipenem	50	60
Ceftazidime + Amikacin	75	80
Amikacin + Imipenem	75	80

Table 6 shows the comparison between the synergism of different antibiotic combinations in MDR M. morganii in vitro and in vivo. While combining ceftazidime and imipenem, they showed 50% synergistic effect in vitro and 60% synergistic effect in vivo. While combining ceftazidime and amikacin, they showed 75% synergistic effect in vitro and 80% synergistic effect in vivo. While combining amikacin and imipenem, they showed 75% synergistic effect in vitro and 80% synergistic effect in vivo.

Discussion

Morganella morganii, a non-negligent opportunistic pathogen of the family Enterobacteriaceae, has recently been enlisted in the global priority pathogens by WHO due to its rapid acquisition of drug-resistance genes, leading to increased mortality rates[19].

Antibiotic resistance has become a widespread problem, particularly documented over the last two decades as a global threat to public health. Approximately 70% of bacteria responsible for hospital-acquired (nosocomial) infections are resistant to at least one common antibiotic previously used to treat them, with many strains now exhibiting multidrug resistance (MDR)[20].

In Bangladesh, there is limited data regarding M. morganii, with only one study conducted on cattle in Dhaka[21]. The present study was carried out to highlight the significance of M. morganii as an emerging nosocomial pathogen, its multidrug resistance, and the evaluation of antibiotic combination therapy as an alternative treatment option for these difficult-to-treat MDR isolates.

Among 550 samples, 74% yielded culture-positive results. Among these, the most common organism was Escherichia coli (28.99%), followed by Pseudomonas spp. (17.94%). A previous study in DMCH reported nearly similar results[22].

The overall prevalence rate of M. morganii in this study was 1.72% among the culture-positive samples, which closely aligns with findings from Taiwan (1.47%)[23]. Another study from India reported a prevalence rate of 0.89%[24]. The higher prevalence in the present study might be attributed to the use of broad-spectrum cephalosporins in admitted patients at DMCH, to which M. morganii is commonly resistant due to the presence of chromosomal AmpC β-lactamase. Additionally, difficulties in routine laboratory identification due to similarities with other bacteria (e.g., Providencia spp., Proteus spp.) may contribute to underreporting in some studies. A study in Iraq reported a higher prevalence of 4%, likely due to targeting high-risk patients such as those with diabetes, trauma, catheterization, or advanced age[25].

In this study, 85.72% of M. morganii isolates were obtained from inpatients, suggesting hospital-acquired infections. Similar findings were reported in a study from China[26].

This study emphasizes that urinary tract infections (42.85%) and wound infections (28.57%) were the most common infections caused by M. morganii. Similar findings were reported in China[26]. Conversely, a study from Serbia reported higher isolation from pus than urine[27]. The higher UTI prevalence in this study may be attributed to catheterization, which facilitates bacterial colonization in the urinary bladder, or to the proximity of the perianal region, where these bacteria can be colonized even in healthy individuals. The perianal region's proximity might also explain higher isolation from pus collected from lesions below the waist. However, catheterization data and pus collection sites were not recorded in this study.

Males (71.42%) were predominantly infected in this study, a finding also reported in Taiwan. The reason for this male predominance remains unclear but may be related to gender disparities in healthcare-seeking behavior. Additionally, males are more prone to trauma due to

outdoor activities, leading to increased wound infections and hospitalization.

The antibiogram demonstrated maximum sensitivity to amikacin (42.85%) and imipenem (42.85%), aligning with findings from Iraq[11]. Higher resistance was observed against cephalosporins such as ceftriaxone (71.42%), ceftazidime (71.42%), cefepime (71.42%), and cefoxitin (71.42%). This high resistance could be due to chromosomally mediated inducible β-lactamases, leading to treatment failure despite initial susceptibility.

Imipenem resistance was observed in 57.14% of M. morganii isolates, with MIC values ranging from 16-128 μg/ml. A recent study at DMCH reported that 25% of Proteus mirabilis isolates were resistant to imipenem, showing similar MIC values[26]. Similar resistance patterns were reported in Nepal[3]. The increasing resistance in this study may be attributed to the growing use of carbapenems due to resistance in broad-spectrum cephalosporins and other β-lactam drugs.

Amikacin resistance was observed in 57.14% of M. morganii isolates, with MIC values ranging from 256-2048 μg/ml. A DMCH study reported that 68.18% of Proteus mirabilis isolates were resistant to amikacin with similar MIC values (12). However, an Iraqi study reported only 17.6% resistance to amikacin[11]. The higher resistance in this study may be due to DMCH being a tertiary care hospital where patients in ICU and burn units are at high risk of nosocomial infections and transmission of MDR isolates.

Ceftazidime resistance was observed in 57.14% of M. morganii isolates, with MIC values of 64-512 μg/ml. A study in Pakistan reported 60% ceftazidime resistance, which is similar to this study[29].

Using the DDS test, ESBL production was detected in 28.57% of M. morganii isolates. A DMCH study detected 22.73% ESBL-producing Proteus mirabilis, similar to the present findings[26]. Another DMCH study detected 38.46% ESBL-producing Citrobacter freundii[30]. A study from Pakistan reported 12% ESBL-producing M. morganii[29]. The high prevalence of ESBL in this study may be due to the overuse of extended-spectrum antibiotics.

BlaCTX-M and blaTEM were the detected ESBL-encoding genes in this study. A DMCH study reported a high prevalence of blaCTX-M-15 and blaCTX-M[32]. A similar study in Iraq also reported the presence of these genes[11]. Specific primers for SHV did not detect any ESBL genes in this study.

Among the imipenem-resistant M. morganii isolates, 50% were detected as carbapenemase producers using the CD assay, followed by 25% using the DDS test. The CD assay was found to be more sensitive and specific. Similar findings were reported in a DMCH study[31]. However, phenotypic tests do not offer optimal sensitivity and specificity, so genotypic tests such as PCR are recommended.

MDR was detected in 57.14% of M. morganii isolates, while 14.28% were extensively drug-resistant (XDR), and no pan-drug-resistant (PDR) strains were identified. A study from China reported 12% MDR M. morganii[25], while a study from the Czech Republic reported 100% MDR[32]. The high MDR prevalence in this study may be due to over-the-counter antibacterial use, incomplete therapy, and indiscriminate broad-spectrum antibiotic use in hospitalized patients.

Conclusion

This study underscores the emerging threat posed by Morganella morganii as a multidrug-resistant nosocomial pathogen. The high prevalence of antimicrobial resistance, particularly to cephalosporins and carbapenems, highlights the urgent need for enhanced antibiotic stewardship and robust infection control measures in hospital settings. Detecting ESBL and carbapenemase-producing strains further emphasizes the necessity of routine molecular surveillance to track resistance patterns. Given the increasing resistance trends, combination therapy and alternative treatment approaches should be explored to combat M. morganii infections effectively. Future research should focus on genotypic resistance mechanisms and explore novel therapeutic strategies to mitigate the growing burden of drug-resistant M. morganii in healthcare settings.

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Original Article

Prevalence of AmpC-Producing Klebsiella spp. and Escherichia coli and Their Antibiotic Susceptibility Profiles in Urinary Samples in the Southwest Region of Bangladesh

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Abstract

Background: The increasing prevalence of antibiotic-resistant pathogens, particularly AmpC-producing Klebsiella spp. and Escherichia coli, poses a significant challenge in managing urinary tract infections (UTIs) in the southwest region of Bangladesh. Objective: This study aimed to investigate the prevalence of AmpC-producing Klebsiella spp. and E. coli in clinical urine samples and to assess their antibiotic susceptibility profiles. Methods: 51 urine samples were collected from patients at Ibn Sina Hospital and Nurul Islam Diabetic Hospital, Jashore, Bangladesh, between January and March 2025, with suspected UTIs at a tertiary healthcare facility in the southwest region of Bangladesh. Bacterial identification was performed using standard microbiological techniques, and the production of AmpC β-lactamase was confirmed through phenotypic testing. Results: Of the 51 urine samples, 34 (66.7%) yielded bacterial growth. E. coli was the most predominant pathogen, accounting for 54.9%, followed by Klebsiella spp. at 31.4%. 57.1% of E. coli and 75% of Klebsiella spp. isolates were found to produce AmpC β-lactamase. Both pathogens exhibited high resistance to commonly used antibiotics, including ampicillin (85.7% in E. coli and 87.5% in Klebsiella spp.), ceftriaxone (71.4% in E. coli and 75% in Klebsiella spp.), and ciprofloxacin (64.3% in E. coli and 62.5% in Klebsiella spp.). Nitrofurantoin demonstrated relatively low resistance rates, with 14.3% for E. coli and 12.5% for Klebsiella spp. Conclusion: The high levels of multidrug resistance emphasize the urgent need for effective antimicrobial stewardship and alternative treatment options, such as nitrofurantoin, to manage UTIs caused by resistant pathogens. These findings underscore the importance of continued surveillance of antibiotic resistance and the development of targeted treatment strategies in the region.

Keywords: AmpC-producing Klebsiella spp., Escherichia coli, antibiotic resistance, urinary tract infections.

Introduction

Escherichia coli and Klebsiella pneumoniae are among the primary causative agents of both nosocomial and community-acquired infections, notably contributing to conditions such as primary bacteremia, urinary tract infections, and intra-abdominal infections[1,2]. In recent years, the global rise in antimicrobial resistance has been alarming, particularly due to the emergence of antibiotic-resistant strains producing AmpC beta-lactamases (AmpCs) and extended-spectrum beta-lactamases (ESBLs) among Enterobacteriaceae, with E. coli and K. pneumoniae being the predominant species involved. These enzymes, especially ESBLs and AmpCs, are of critical clinical concern[3-6].

AmpCs are cephalosporinases commonly encoded on the chromosomes of several Enterobacteriaceae species, conferring resistance to a broad range of beta-lactam

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antibiotics. In contrast, ESBLs are mutant derivatives of common beta-lactamases, having undergone amino acid substitutions near the enzyme's active site. These structural changes enhance their ability to hydrolyze third-generation cephalosporins and monobactams, rendering them less effective[3,4]. The widespread use of newer cephalosporins has significantly contributed to the selection pressure favoring the emergence of these resistant enzymes. Moreover, as many of these beta-lactamase genes are located on conjugative plasmids, their horizontal transfer is facilitated, often co-transmitting resistance to other antibiotics such as aminoglycosides[7]. Initially, CTX-M-producing strains were reported only in specific regions during the 1990s, but over the last decade, their prevalence has surged worldwide. Recent epidemiological studies have confirmed a significant global rise in CTX-M enzymes among ESBL-producing organisms[8]. Additionally, in species that do not naturally express AmpC, the presence of plasmid-mediated AmpC (pAmpC) has been increasingly observed[9]. These pAmpCs are categorized into seven major families: ACC (Ambler class C-1), CMY, DHA, FOX, MIR, ACT, and MOX, with CMY-2 being the most prevalent variant globally[10,11]. Similarly, most ESBLs fall into three key families: CTX-M, SHV, and TEM[12,13]. Regional studies, such as those conducted in northwestern Iran in 2015 and 2016, have explored both genotypic and phenotypic characteristics of ESBL- and AmpC-producing isolates[14,15]. Klebsiella spp. and Escherichia coli are major pathogens implicated in both hospital- and community-acquired infections. The emergence of AmpC beta-lactamase-producing strains among these organisms poses a significant threat to effective antimicrobial therapy. AmpC enzymes confer resistance to broad-spectrum cephalosporins and are often associated with multidrug resistance due to plasmid-mediated gene transfer. In recent years, their prevalence has increased globally, including in South Asia. However, data from the southwest region of Bangladesh remain limited. This study aims to determine the prevalence of AmpC-producing Klebsiella spp. and E. coli and assess their antibiotic susceptibility profiles in this region.

Methodology

This study was conducted in the southwest region of Bangladesh, focusing on the prevalence of AmpC-producing Klebsiella spp. and Escherichia coli and their antibiotic susceptibility profiles. A total of 51 midstream urine samples were collected from patients presenting with symptoms of urinary tract infections (UTIs) at Ibn Sina Hospital and Nurul Islam Diabetic Hospital, Jashore, Bangladesh, between January and March 2025. Each sample was collected using the clean-catch method to reduce contamination risk. The samples were immediately transported to the microbiology laboratory under proper aseptic conditions and processed within two hours of collection to ensure sample integrity. In the laboratory, urine samples were cultured on selective media, including Cystine-Lactose-Electrolyte-Deficient (CLED) agar and MacConkey agar, to isolate Gram-negative bacteria, particularly uropathogens such as Klebsiella spp. and E. coli. After incubation at 37°C for 18-24 hours, bacterial colonies were identified based on their colony morphology, Gram staining, and a series of biochemical tests, including catalase, oxidase, indole, citrate utilization, urease activity, and triple sugar iron (TSI) reaction. For further confirmation of the bacterial species, commercial identification systems (e.g., API 20E for Gram-negative organisms) were used. AmpC production was determined using a phenotypic confirmatory test, where isolates showing resistance to beta-lactam antibiotics, such as cefoxitin, were further tested for the presence of AmpC β-lactamase production. The antibiotic susceptibility of the isolates was assessed using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar, in accordance with the guidelines set by the Clinical and Laboratory Standards Institute (CLSI). A range of antibiotics, including ampicillin, amoxicillin-clavulanic acid, ceftriaxone, cefoxitin, ciprofloxacin, and gentamicin, was tested to evaluate resistance patterns. Isolates were categorized as resistant, intermediate, or susceptible based on the zone diameter breakpoints provided by CLSI. Multidrug resistance (MDR) was defined as resistance to at least one agent in three or more different antibiotic classes. Quality control was maintained by

simultaneously processing reference strains of Escherichia coli ATCC 25922 and Staphylococcus aureus ATCC 25923 to ensure the accuracy and reliability of the test results. Data were recorded and analyzed using descriptive statistics to identify the prevalence of AmpC-producing Klebsiella spp. and E. coli and their respective antibiotic resistance profiles.

Results

A total of 51 urine samples were analyzed in this study to assess the prevalence of AmpC-producing Klebsiella spp. and Escherichia coli, along with their antibiotic susceptibility profiles. The following tables present the distribution of bacterial isolates, AmpC production rates, and antibiotic resistance profiles.

Table 1: Distribution of Bacterial Isolates from Urine Samples (n=51)

Pathogen	Number of Isolates (n=51)	Percentage (%)
Escherichia coli	28	54.9%
Klebsiella spp.	16	31.4%
Proteus mirabilis	4	7.8%
Enterococcus faecalis	3	5.9%

Table 1 presents the distribution of bacterial isolates recovered from the 51 urine samples. Escherichia coli was the most prevalent pathogen, accounting for 54.9% (28/51) of the isolates. Klebsiella spp. followed with 31.4% (16/51), while Proteus mirabilis and Enterococcus faecalis were less frequently isolated, contributing 7.8% (4/51) and 5.9% (3/51), respectively. These findings align with previous studies, where E. coli and Klebsiella spp. are commonly identified as the leading pathogen in urinary tract infections.

Table 2: Prevalence of AmpC β-lactamase Production in Klebsiella spp. and Escherichia coli (n=44)

Pathogen	AmpC Producers	Total Isolates	Percentage of AmpC Producers (%)
Escherichia coli	16	28	57.1%
Klebsiella spp.	12	16	75.0%

Table 2 shows the prevalence of AmpC β-lactamase production in Klebsiella spp. and E. coli. Of the 44 isolates that were tested for AmpC production, 57.1% (16/28) of E. coli strains and 75.0% (12/16) of Klebsiella spp. strains produced AmpC β-lactamase. These results indicate that AmpC production is highly prevalent in both Klebsiella spp. and E. coli, suggesting a significant level of resistance to β-lactam antibiotics in these pathogens. The higher AmpC production rate in Klebsiella spp. (75%) compared to E. coli (57.1%) highlights the emerging threat of AmpC β-lactamase-producing pathogens in urinary tract infections.

Table 3: Antibiotic Resistance profiles of Escherichia coli (n=28)

Antibiotic	Resistant (n=28)	Percentage (%)
Ampicillin	24	85.7%
Ceftriaxone	20	71.4%
Ciprofloxacin	18	64.3%
Gentamicin	12	42.9%
Amoxicillin - Clavulanic Acid	10	35.7%
Nitrofurantoin	4	14.3%

Table 3 displays the antibiotic resistance profiles of E. coli isolates. High resistance rates were observed against commonly used antibiotics. Resistance to ampicillin was observed in 85.7% of isolates, followed by ceftriaxone (71.4%), ciprofloxacin (64.3%), and gentamicin (42.9%). Resistance to amoxicillin-clavulanic acid was lower, with 35.7% of isolates showing resistance. Interestingly, resistance to nitrofurantoin, a commonly used antibiotic for urinary tract infections, was relatively low at 14.3% . This suggests that nitrofurantoin may remain an effective option for treating E. coli-related UTIs in this region.

Table 4: Antibiotic Resistance Profiles of Klebsiella spp. (n=16)

Antibiotic	Resistant (n=16)	Percentage (%)
Ampicillin	14	87.5%
Ceftriaxone	12	75.0%
Ciprofloxacin	10	62.5%
Gentamicin	8	50.0%
Amoxicillin - Clavulanic Acid	6	37.5%
Nitrofurantoin	2	12.5%

Table 4 shows the antibiotic resistance profiles of Klebsiella spp. isolates. Similar to E. coli, Klebsiella spp. exhibited high resistance to ampicillin (87.5%) and ceftriaxone (75.0%), with notable resistance to ciprofloxacin (62.5%) and gentamicin (50.0%). The resistance rates for amoxicillin-clavulanic acid and nitrofurantoin were lower, at 37.5% and 12.5%, respectively. This further corroborates the concern over the emergence of multidrug-resistant Klebsiella spp. strains, which complicate treatment options for UTIs in this region.

Table 5: Comparison of AmpC Production and Antibiotic Resistance in Klebsiella spp. and Escherichia coli (n=44)

Pathogen	AmpC Positive	AmpC Negative	Resistant to ≥3 Antibiotics	(%)
Escherichia coli	16	12	20	71.4%
Klebsiella spp.	12	4	10	83.3%

Table 5 compares the AmpC production and antibiotic resistance profiles of Klebsiella spp. and E. coli. Of the total 44 isolates, 71.4% (20/28) of E. coli and 83.3% (10/16) of Klebsiella spp. were resistant to at least three different classes of antibiotics. The data indicated that both E. coli and Klebsiella spp. are highly resistant to multiple antibiotics, with Klebsiella spp. showing a slightly higher prevalence of multidrug resistance.

Discussion

These findings highlighted the growing concern over the spread of AmpC-producing strains in both pathogens, which poses significant challenges for treatment, particularly in UTIs[9]. The results of this study highlight the increasing prevalence of AmpC-producing Klebsiella spp. and Escherichia coli as significant uropathogens in the southwest region of Bangladesh. Our findings indicate that these pathogens are not only highly prevalent but also exhibit substantial resistance to commonly used antibiotics, underscoring the growing threat of antimicrobial resistance (AMR) in urinary tract infections (UTIs)[13]. In this study, E. coli was the most predominant pathogen, isolated from 54.9% of the urine samples, followed by Klebsiella spp., which accounted for 31.4%. These findings align with several previous studies conducted globally and regionally, which consistently report E. coli as the leading cause of UTIs, especially in community settings[3,14]. The high isolation rate of E. coli in this study is consistent with its ability to colonize the urinary tract and its virulence factors, including the production of adhesins, which allow the pathogen to bind to the urinary tract epithelium and evade host defenses13. Klebsiella spp., though less

prevalent than E. coli, is another important uropathogen associated with both community-acquired and healthcare-associated infections, particularly in patients with underlying comorbidities[1,4]. One of the key findings of this study is the high prevalence of AmpC β-lactamase production in both Klebsiella spp. and E. coli. AmpC β-lactamase-producing strains are of particular concern because they confer resistance to a broad range of β-lactam antibiotics, including cephalosporins and penicillins, which are commonly used to treat UTIs[5,9,10]. In this study, 75.0% of Klebsiella spp. and 57.1% of E. coli isolates were found to be AmpC producers. These findings are in line with previous studies from both developing and developed countries, where AmpC production is emerging as a major mechanism of resistance in Klebsiella and E.coli[6,11,14,15]. The higher prevalence of AmpC production in Klebsiella spp. (75%) compared to E. coli (57.1%) may reflect the greater capacity of Klebsiella to acquire and express AmpC genes, which are often carried on plasmids, allowing for rapid spread in bacterial populations[12]. The emergence of AmpC-producing strains is particularly concerning as it limits the effectiveness of several first and second-line antibiotics commonly used to treat UTIs[7,9]. Furthermore, the presence of AmpC β-lactamases complicates treatment options, as it may necessitate the use of more expensive or less readily available antibiotics, such as carbapenems, which should ideally be reserved for more severe or hospital-acquired infections to prevent the development of resistance[7,9,13]. The resistance profiles of E. coli and Klebsiella spp. isolates in this study revealed a high level of multi-drug resistance, consistent with the global rise of AMR[13,17]. E. coli exhibited resistance rates of 85.7% to ampicillin, 71.4% to ceftriaxone, and 64.3% to ciprofloxacin, while Klebsiella spp. showed similarly high resistance to ampicillin (87.5%) and ceftriaxone (75.0%)[14,17]. These resistance patterns reflect the widespread use of these antibiotics in clinical settings and their selective pressure on bacterial populations[8,16]. The high resistance to ciprofloxacin in both pathogens suggests the development of fluoroquinolone resistance, which is particularly

concerning given that fluoroquinolones have traditionally been used as first-line agents for complicated UTIs[13]. Interestingly, resistance to nitrofurantoin was relatively low in both pathogens (14.3% in E. coli and 12.5% in Klebsiella spp.), suggesting that nitrofurantoin may still be an effective option for the treatment of UTIs in this region[17,18]. Nitrofurantoin is often considered a reliable option for treating uncomplicated UTIs, especially in women, and its relatively low resistance rates in this study highlight its potential utility in the context of rising resistance to other antibiotics[13]. The overall antibiotic resistance patterns observed in this study are concerning, as they underscore the urgent need for effective antimicrobial stewardship programs to limit the overuse and misuse of antibiotics in both community and healthcare settings[9,13]. Additionally, the emergence of multidrug-resistant strains highlights the importance of ongoing surveillance of AMR to inform treatment guidelines and to prevent the spread of resistant pathogens[14,15]. One of the most significant findings of this study is the high level of multidrug resistance among both E. coli and Klebsiella spp. isolates. Of the total 44 AmpC-producing isolates, 71.4% of E. coli and 83.3% of Klebsiella spp. were resistant to at least three classes of antibiotics[5,13,15]. This level of multidrug resistance poses a major challenge for the treatment of UTIs, as it limits the available therapeutic options. The findings also highlight the need for rapid diagnostic methods to detect resistant strains early, allowing for more targeted and effective treatment strategies[11,12,16].

Limitations and Future Directions

While this study provides valuable insights into the prevalence of AmpC-producing Klebsiella spp. and E. coli in the southwest region of Bangladesh, there are some limitations to consider. First, the study focused on urine samples, and the results may not fully represent the broader spectrum of AmpC-producing pathogens in other infection sites. Second, the sample size of 51 urine samples may limit the generalizability of the findings. Further studies with larger sample sizes and more diverse sample types (e.g., blood,

wound, and respiratory samples) are needed to better understand the regional burden of AmpC-producing pathogens and their antibiotic resistance profiles. Additionally, the study did not explore the genetic mechanisms behind AmpC production, such as the identification of specific genes (e.g., blaAmpC or plasmid-mediated AmpC genes). Future studies should aim to characterize the molecular basis of AmpC resistance and the potential for horizontal gene transfer, which can contribute to the spread of resistance in clinical settings.

Conclusions

In conclusion, this study provides important data on the prevalence of AmpC-producing Klebsiella spp. and E. coli in urine samples from the southwest region of Bangladesh. The high prevalence of AmpC production and multidrug resistance underscores the need for vigilant antimicrobial surveillance and the implementation of effective antimicrobial stewardship programs. The results also highlight the importance of alternative treatment options, such as nitrofurantoin, in the management of UTIs caused by resistant pathogens. Ongoing efforts to combat antibiotic resistance in Klebsiella spp. and E. coli are critical to improving patient outcomes and reducing the burden of antimicrobial-resistant infections in this region.

Author Contributions

Tahmina Monowar, Kazy Noor e Alam Siddiquee, and Farhana Nazneen Jui conceived and designed the study. Tahmina Monowar prepared the questionnaire, and Pushpita Islam collected samples. Tahmina Monowar and Kazy Noor-e-Alam Siddiquee analyzed the data and interpreted the results. Tahmina Monowar wrote the draft manuscript. Tahmina Monowar, Farhana Nazneen Jui, Kazy Noor e Alam Siddiquee, and Nazmun Nahar Alam reviewed and edited the manuscript. All authors read and approved the final manuscript.

Conflicts of interest

The authors declare no conflict of interest.

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Tuberculosis in the 21st Century: A Comprehensive Global Review

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Abstract

Tuberculosis (TB) remains a major global health challenge, responsible for significant morbidity and mortality. Despite advancements in diagnosis and treatment, TB remains difficult to eradicate due to its slow-growing nature, diagnostic limitations, and increasing drug resistance. The World Health Organization (WHO) aims to achieve a 90% reduction in TB incidence between 2015 and 2035; however, progress has been hindered by disruptions caused by the COVID-19 pandemic. In 2022, TB was responsible for 1.3 million deaths worldwide, with Southeast Asia and Africa accounting for the highest burden. The rise in drug-resistant TB, particularly multidrug-resistant and rifampicin-resistant strains, poses additional challenges to disease control efforts. Although molecular diagnostic tools such as nucleic acid amplification tests (NAATs) have improved detection rates, their accessibility remains limited in high-burden areas. TB treatment regimens continue to rely on decades-old antibiotics, and emerging resistance necessitates novel therapeutic combinations. Preventive strategies, including vaccination and shorter treatment regimens for latent TB, are essential in reducing transmission. However, socioeconomic factors such as poverty, overcrowding, and limited healthcare access exacerbate the spread of TB, underscoring the need for strengthened public health interventions. Urgent global action is required to enhance diagnostic capacity, improve treatment accessibility, and accelerate progress toward TB eradication.

Introduction

Tuberculosis (TB) represents a significant topic concerning a widespread disease that is difficult to diagnose, treat, and prevent. Throughout history, TB has caused more deaths than any other infectious disease[1]. Caused by Mycobacterium tuberculosis, TB is a preventable illness. The World Health Organization has set an ambitious target of achieving a 90% reduction in TB incidence between 2015 and 2035. Before the onset of the SARS-CoV-2 pandemic, TB was recognized as the most prevalent infectious disease worldwide.

In contrast to SARS-CoV-2, M. tuberculosis has been a human pathogen for millennia. Robert Koch announced his discovery of the Mtb bacterium in 1882, and its complete genome was sequenced over a century later[2]. The Mantoux skin test, developed in 1909, continues to be utilized today

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with minor adjustments in reagents and interpretive criteria. The interferon-gamma release assay (IGRA), introduced in 2014, offers an alternative method for diagnosing TB[3]. Both tests possess diagnostic and predictive limitations that necessitate a nuanced understanding of their interpretive criteria. The bacterium grows slowly, is often sparse, and can be challenging to identify in sputum and tissue samples[4]. The recent introduction of molecular nucleic acid amplification tests (NAATs) has alleviated some of these challenges in confirming TB diagnoses. However, NAATs are not widely accessible in many regions where TB is most prevalent. Determining the optimal timing and methods for implementing these tests remains an ongoing challenge. New diagnostic tests aimed at improving accuracy are gradually emerging[5].

Administering the regimens required for TB treatment can be complex. The primary anti-TB antibiotics currently used were developed in the mid-20th century and continue to serve as the foundation of therapy. For the first time in over four decades, two new anti-TB antibiotics have recently received approval for use[6]. Treatment regimens

differ based on the stage and anatomical site of the infection, the host's immune status and age, comorbidities present, potential toxicities, drug-drug interactions, and the resistance patterns exhibited by the bacterium. The increasing resistance of tuberculosis to antibiotics necessitates the use of novel antibiotic combinations that have undergone limited clinical trial testing. Additionally, the lengthy duration of therapy required to eliminate the organism poses another significant challenge. Recently developed shorter treatment regimens for latent TB infection aim to reduce adverse effects and enhance patient adherence[7]. Preventing TB remains a global challenge due to its ease of transmission; conditions characterized by poverty, overcrowding, and insufficient public health infrastructure exacerbate its spread. Nonspecific symptoms such as a persistent cough often go unnoticed, leading to high transmission rates[8]. In cases of active TB, the multiple antibiotics needed for treatment and their extended administration period present challenges even in areas with strong public health systems[9]. Indeed, regions with the highest prevalence of TB frequently lack adequate public health resources. Conversely, in resource-rich areas where TB is relatively rare, many clinicians encounter the disease infrequently, lack familiarity with its clinical manifestations, and possess limited experience with diagnosis and management approaches[10].

Methods

This review article synthesizes data from various sources, including WHO reports, peer-reviewed journals, and other relevant literature published between 2000 and 2023. The search strategy involved using keywords such as "tuberculosis," "global burden," "drug-resistant TB," "risk factors," "treatment," and "public health strategies." Articles were selected based on their relevance to contemporary TB issues and their contribution to understanding the disease's epidemiology, treatment advancements, and control measures.

Results

The WHO publishes an annual report that details the current epidemiology of tuberculosis (TB) and assesses progress towards the goals outlined in the WHO End TB Strategy.[12] In 2022, TB was responsible for 1.3 million deaths globally, reflecting a decrease from the estimated 1.4 million deaths reported in both 2020 and 2021. TB

remains the leading cause of death among individuals with HIV, accounting for 167,000 fatalities in 2022. Approximately 7.5 million people received a TB diagnosis in 2022, with 46% residing in Southeast Asia, 23% in Africa, and 18% in the Western Pacific. This figure represents the highest number recorded since global TB monitoring commenced in 1995. Currently, around 10.6 million individuals worldwide are living with active TB, including 5.8 million men, 3.5 million women, and 1.3 million children. Additionally, about 25% of the global population is infected with TB, with an estimated 5% to 10% progressing to active disease[13].

In the United States (US), the Centers for Disease Control (CDC) reported 9,615 new cases of TB in 2023 (approximately 2.9 cases per 100,000 persons), an increase from the 8,300 cases documented in 20228. This marks a 16% rise and adds to the annual increases observed since 2020, following a decline lasting 27 years. The rise in cases has been noted across various age groups and among both US-born and non-US-born individuals across 40 states and the District of Columbia[14]. The most significant relative increase in case numbers and rates was observed in children aged 5 to 14 years (42% and 45%, respectively), although this group had only 68 cases. Seventy-six percent of reported cases occurred among individuals born outside the US, reflecting a 16% increase in this demographic. While TB poses a minimal risk to US-born individuals, higher incidence rates are evident among Native Hawaiians, Pacific Islanders, American Indians, Alaska Natives, and Black individuals, highlighting ongoing public health disparities[15]. Approximately 85% of reported cases are linked to the reactivation of latent TB infection rather than recent transmission events. Coinfection with HIV was present in about 5% of patients diagnosed with TB. Both within the US and globally, significant progress made towards eradicating TB has been compromised since the onset of the COVID-19 pandemic. The emphasis on diagnosing and treating COVID-19 has led healthcare professionals within public health systems to identify fewer latent and active TB9 cases[16]. The decline in latent and active infections observed in 2020 is likely attributable to these healthcare disruptions8. Additionally, reduced migration patterns in some jurisdictions, including the US,

contributed to lower incidence rates of infections during that year. On a global scale, disruptions caused by COVID-19 resulted in an estimated half a million excess deaths due to TB between 2020 and 2022 compared to what would have occurred had pre-pandemic trends continued[17].

The increased incidence of latent and active infections since either 2021 or 2022 likely indicates a backlog of individuals whose TB diagnoses were delayed. Between the years of 1995 and 2014, efforts to control TB prevented approximately 300,000 people from developing the disease, resulting in savings of around $14.5 billion. Drug-resistant TB remains a significant public health challenge; globally, about 13% of new cases and approximately 17% of previously treated cases exhibit isoniazid (INH) resistance while remaining susceptible to rifampin (RIF)[10].

Discussion
In 2023, an estimated 10.8 million people worldwide (95% UI: 10.1–11.7 million) developed tuberculosis (TB), marking a continued increase from 10.7 million in 2022 (95% UI: 10.0–11.5 million), 10.4 million in 2021 (95% UI: 9.7–11.1 million), and 10.1 million in 2020 (95% UI: 9.5–10.7 million). This persistent rise reflects the lingering impact of disruptions to TB services during the peak years of the COVID-19 pandemic in 2020 and 2021. However, the global increase in TB incidence appears to be slowing down and may soon stabilize[11].

Drug-resistant TB remains a significant public health concern, particularly resistance to rifampicin, the most potent first-line drug. TB that is resistant to both rifampicin and isoniazid is classified as multidrug-resistant TB (MDR-TB). Both MDR-TB and rifampicin-resistant TB (RR-TB) require second-line treatment. Between 2020 and 2023, the global burden of MDR/RR-TB remained relatively stable, following a slow decline from 2015 to 202012. In 2023, approximately 400,000 people (95% UI: 360,000–440,000) developed MDR/RR-TB. Unlike the overall increase in TB cases, MDR/RR-TB rates have not followed the same upward trend in recent years[13-18].

TB-related deaths continued to decline in 2023, reversing the increases seen during the COVID-19 pandemic. In 2023, an estimated 1.25 million people (95% UI: 1.13–1.37 million) died from TB, including 1.09 million HIV-nega-

tive individuals (95% UI: 0.98–1.20 million) and 161,000 people with HIV (95% UI: 132,000–193,000). This represents a decrease from 1.32 million deaths in 2022 (95% UI: 1.21–1.45 million), 1.42 million in 2021 (95% UI: 1.29–1.55 million), and 1.40 million in 2020 (95% UI: 1.27–1.54 million). The total number of TB-related deaths in 2023 also fell below pre-pandemic levels, which stood at 1.34 million in 2019 (95% UI: 1.22–1.46 million). However, COVID-19 disruptions are estimated to have caused approximately 700,000 excess TB deaths between 2020 and 2023, compared to projections based on pre-pandemic trends[13-18].

The global response to TB remains off track in meeting the End TB Strategy targets. The first milestones, set for 2020, aimed to achieve a 35% reduction in TB-related deaths and a 20% decline in TB incidence compared to 2015 levels. The second milestones, set for 2025, target a 75% reduction in deaths and a 50% decrease in incidence. However, progress has been significantly hindered by setbacks during the COVID-19 pandemic. Between 2015 and 2023, the global TB incidence rate decreased by only 8.3%, far from the 50% target set for 2025. Among WHO regions, the European Region achieved the largest reduction in TB incidence, with a 27% decline by 2023, though progress stalled between 2019 and 2023. Similarly, the African Region recorded a 24% decline. These two regions are the only ones to surpass the first milestone of the End TB Strategy. Other regions saw limited progress: the Eastern Mediterranean recorded a 3.4% decline, South-East Asia 6.7%, and the Western Pacific 3.5%. Notably, the Americas reported a concerning 20% increase in TB incidence[13-18].

Looking ahead, global TB incidence may stabilize or even begin to decline in 2024, as the rate of increase slowed to 0.2% between 2022 and 2023, compared to 2.2% in the previous two years. If the recent recovery in TB diagnosis and treatment efforts continues, the number of TB-related deaths should also keep decreasing. However, at the country level, the challenge of returning to pre-pandemic downward trends remains greatest in nations that experienced severe disruptions to TB services in 2020 and 2021. Indonesia and the Philippines, in particular, have significantly influenced global TB trends. Both countries have shown strong recoveries in 2022 and 2023, helping to moderate the overall rise in TB cases and associated deaths13-18.

Conclusion

Tuberculosis (TB) remains a major global health threat, particularly in low- and middle-income countries. Despite progress in diagnostics and treatment, challenges like drug-resistant TB, healthcare disparities, and global crises persist. While TB incidence and mortality are declining post-pandemic, they remain above WHO targets. Socioeconomic and infrastructural barriers hinder effective control, requiring stronger healthcare systems and integrated public health efforts. Advancing vaccines, diagnostics, and equitable access to care is essential. Achieving TB eradication demands continued research, policy advocacy, and global collaboration.

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Case Report

Chronic Ectopic Pregnancy Vs Tubo-Ovarian Abscess: A Hesitance in Diagnosis and Challenge for Gynaecological Practice

Maliha Nawal[1]*, Sharmin Akter[2], Md Mukshudus Saleheen[3]

Abstract

Background: *Ectopic pregnancy exhibits a wide range of clinical presentations. Chronic ectopic pregnancy, a variant of ectopic pregnancy poses a challenge for obstetricians because of its non-classical symptoms and limitations in its diagnosis. Sometimes it mimics with tubo-ovarian abscess. Chronic ectopic pregnancy may cause complications to the patients in case of delayed detection. A prolonged clinical course is typical and surgery is the mainstay of treatment.*

Keywords: *Chronic ectopic pregnancy, Tubo-ovarian abscess*

Introduction

When a fertilized ovum is implanted outside the endometrial cavity, it gives rise to an ectopic pregnancy (EP). It is the leading cause of maternal morbidity and mortality in the first few months of gestation.[1] Apart from the normal site, ectopic nidus can be embedded in the fallopian tubes followed by the ovary, cervix, and intra-abdominal region. History of pelvic surgery, pelvic inflammatory disease, history of infertility, assisted reproductive techniques and different contraceptive exposure are among the most important risk factors.[2] Secondary amenorrhoea followed by light vaginal spotting and pelvic pain are the classical presentations of unruptured ectopic pregnancy and if rupture occurs, acute abdominal symptoms can be seen together.[3] Chronic ectopic pregnancy (CEP) usually presents with variable and non-specific symptoms. The exact cause is difficult to ascertain sometimes as there is no specific universal triad for diagnosis.[4]

It develops when the trophoblastic tissue gradually invades the implantation site for days, bleeds sparsely, and creates minor pores instead of a single episode of haemorrhagic burst, thus leading to the development of a pelvic mass.[5]

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Tubo-ovarian abscess (TOA), a dreadful drawback of pelvic infection, is also usually seen in women of childbearing age and mostly polymicrobial agents are accountable for the etiopathogenesis.[5] TOA is usually seen as an inflammatory mass involving the female internal reproductive system. Potential long-term consequences include an increased risk of EP. Complications like peritonitis and sepsis also affect the health of patients whose treatment is delayed or absent, and these may result in fatality.[6]

Case-report

A 32-year-old Bangladeshi woman P 1(CS) +0 presented to the emergency department of our hospital with 2-month history of irregular per vaginal bleeding without any preceding amenorrhoea, associated with discomfort in the lower abdomen, dysuria and fever. There was no menstrual irregularity or dysmenorrhoea in the past but she was getting treatment for infertility and chronic pelvic pain previously in a clinic. She denied use of any contraceptive methods or history of any surgery other than CS.

Apart from an ill-looking appearance, only pallor was present on the initial general assessment. Her blood pressure was 80/50 mmHg, pulse 120 beats/min, respiratory rate 24/min, and she had a fever showing 100°F. Abdominal examination revealed moderate tenderness in the right iliac fossa. Speculum examination showed a healthy vagina and a healthy-looking cervix smudged with altered blood around the external ostium. A bimanual examination revealed a retroverted normal-sized uterus with fullness in the pouch of Douglas and a positive cervical excitation test.

A laboratory evaluation disclosed the following results: haemoglobin (Hb): 7.0 g/dL, haematocrit: 22%, white blood cell: 10.9 (x10) (mcL), platelet count: 447 (x10°) (mcL), beta-human chorionic gonadotropin (hCG): 542 (mlU/ml). Other tumour markers showed normal study.

Figure 1: Transabdominal USG showing adnexal mass

In the transabdominal ultrasonography evaluation, a complex heterogeneous adnexal mass with a diameter of about 10.9 x 9.0 x 6.7 cm was noted in the pouch of Douglas, which was quite confusing to stand a diagnosis. Detailed information was given to the patient and her husband and it was decided to perform an emergency laparotomy after a course of conservative management. Informed written consent was obtained from the patient. On exploration, the uterus was highly connected with the anterior abdominal wall and peritoneum, the left ovary and tube were natural in appearance. In the right adnexal area, both the fallopian tube and ovary were distorted. An adnexal mass with ectopic sac of approximately 3x2 cm was observed. There was also a finding compatible with an abscess and severe adhesion connected to the rectum and posterior wall of the uterus. After separating all the adhesions, using blunt and sharp dissection, the blood-mixed abscess contents were drained and a right salpingo-oophorectomy was performed.
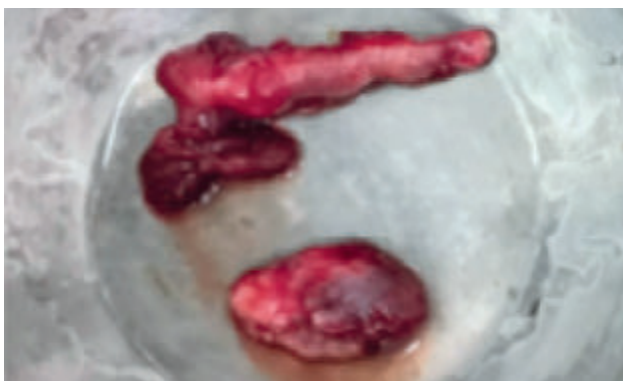

Figure 2: Resected specimen of right fallopian tube and ovary

The inside of the abdomen was washed with approximately 2000 cc of isotonic saline. After confirming haemostasis, a drain was placed in the pouch of Douglas. Specimen was sent for histopathology. Postoperative parenteral dual antibiotic treatment (Meropenem and Metronidazole) was initiated. The patient's fever decreased, laboratory findings compatible with inflammation improved, and the patient was discharged as cured.

Discussion

Both EP and TOA are the important culprits of maternal health problems and fatality in reproductive ages. To diagnose CEP without delay has become a challenge because of disputes with any TO mass. Both of them simulate each other with chronic pelvic pain, menstrual problems, and pyrexia. The protracted nature of symptoms and negative beta HCG levels due to avital trophoblasts confuse the diagnosis between CEP and TOA.[4] Occasionally, they may persist together. The daily routine uses of high-quality image-producing USG devices aid in the detection of EP earlier. But CEP often simulates with any adnexal mass, especially in low resource settings where a robust early pregnancy care service is infrequent. Later on, we need beta HCG levels to come to a final point for further management.[6] However, a final diagnosis is confirmed with the histopathological report.[7]

In spite of all the hesitancy, mortality rates have tended to decrease. The patient's health concern has also added to quicker diagnosis. It is thought that EP occurred as a result of a pelvic infection in our case, where tube mobility is reduced due to inflammation affecting the right ovary and tube. Though laparoscopy is accepted as the gold standard in the diagnosis and treatment of haemodynamically stable EP and TOA. But in our case, the patient was in shock; so, we did perform laparotomy. No complications were observed with the open access method. The decision for salpingectomy or salpingostomy in tubal EP surgery depends on the age of the patient, the desire for fertility and the damage in the tube where the EP is located. In our case, the fallopian tube along with surrounding tissue was highly hydropic, oedematous and damaged. Bloody pus was discharged from the tube, so we removed the right fallopian tube with right ovary. As the patient had desire for fertility so the left tube was preserved.

Conclusion

Unless there is an accurate non-surgical diagnosis of CEP, we believe that surgical management remains the gold standard treatment for this condition. Post-surgery histo-pathological reports associated with per operative findings together aid in a complete diagnosis following pre-operative clinical assessment, beta HCG reports and radiological evaluation. Any delay in making the imperative medical treatment and intervention may cause maternal malady and death. With increased awareness of both caregivers and patients, a good outcome is possible.

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Case Report

Acute pancreatitis: an atypical presentation of hypertriglyceridaemia

Sharmin Akter[1], MD Mustasinul Islam[2], Maliha Nawal[3]

Abstract

Hypertriglyceridaemia is one of the rarest causes of "Acute pancreatitis". Commonly if the serum triglyceride level goes above 1000mg/dl; it can trigger pancreatic inflammation, which leads to pancreatitis. A 45-year-old woman was admitted in our intensive care unit with an acute abdomen and vomiting. After laboratory investigation, we found that; her serum lipase was 4300 U/L, serum Amylase was 2880 U/L, serum triglyceride was 2400 mg/dl and the Ultra-sonogram of the whole abdomen shows a bulky pancreas with peri-pancreatic fluid. For these findings, she was diagnosed as a case of "Hypertriglyceridaemia induced acute pancreatitis "and was treated with insulin infusion and other required medications. After proper monitoring and management, she was discharged after 07 days with no complaints.

Key Words: *Acute pancreatitis, Hypertriglyceridaemia, serum lipase*

Introduction

Hypertriglyceridaemia is a commonly encountered metabolic disorder in regular medical practice. We diagnose this condition by measuring serum triglyceride level, if it is >150 mg/dl; it can call hypertriglyceridaemia1. According to "The endocrine society 2010"; hypertriglyceridaemia can be classified into 04 categories; mild form (150-200 mg/dl), moderate form, (200-999 mg/dl), severe form (1000-1999 mg/dl) and very severe form (>2000 mg/dl)[1]. Acute pancreatitis is one of the well-known medical emergencies with large number of causative factors but gall stones or alcohol is the commonest[2]. Hypertriglyceridaemia is less common but an important etiology of acute pancreatitis as it causes 7% of the cases[3].

Usually, hypertriglyceridaemia-induced acute pancreatitis occurs due to uncontrolled pre-existing dyslipidaemia with secondary triggering factors like uncontrolled diabetes mellitus or alcoholism[3]. A patient can develop pancreatitis

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if the serum triglyceride level goes above 1000 to 2000 mg/dl[4]. In acute pancreatitis, patient may present with acute abdominal pain with vomiting. The diagnostic criteria of this acute condition is; a) acute onset of pain which will be persistent and severe in nature, b) epigastric pain radiating towards the back with elevation of serum lipase level 03 time above reference range, c) diagnostic radiographic record 4 . The main target of treating a case of acute pancreatitis due to hypertriglyceridaemia is always to lower the triglyceride level by insulin infusion which will stimulate the function of lipoprotein lipase activity or by plasmapheresis[5]. Also as supportive medication, fibrate can be used to lower triglyceride. Initially this condition is managed by fluid resuscitation, pain management, nutritional support and insulin therapy. If required later on plasmapheresis is done to lower the triglyceride level[2]. Here we reported a case of a lady developed acute pancreatitis, which was induced by very severe hypertriglyceridaemia (> 2000 mg/dl).

Case presentation: A 45 years old woman was admitted to our intensive care unit with chief complain of "severe abdominal pain for last 06 hours with vomiting for one time". According to the statement of the patient she was suffering from severe upper abdominal pain for 06 hours which was radiating towards the back and she vomited one

time during that period. She was a known case of hypertension and dyslipidaemia for last 07 years, but she was irregular in taking medication. She also had family history of dyslipidaemia. On admission her vitals were normal. On physical examination she was ill looking, her abdomen was soft with positive bowel sound but tenderness was present in her epigastric region. At first we diagnosed her as a case of "Acute abdomen" and started treatment with conservative protocol. At the same time we did some laboratory investigations, where complete blood count shows neutrophilic leukocytosis, serum Amylase was 2880 U/L, serum Lipase was 4300 U/L, in serum lipid profile triglyceride was 2400 mg/dl and total cholesterol was 209 mg/dl, CRP was 90 mg/L with normal LFT (Liver function test), RFT (Renal function test), AST (Aspartate aminotransferase), urine RME, serum electrolyte and RBS (random blood sugar). Ultra-sonogram of whole abdomen shows a bulky pancreas with peri-pancreatic fluid. From these investigations, finally we diagnosed her as a case of "Hypertriglyceridaemia induced acute pancreatitis ". With the confirm diagnosis we stated her management with fluid resuscitation, antibiotic, antiemetic, and NSAIDs. Infusion of insulin with 5% DA (Dextrose in aqua) was started to lower the triglyceride level. She improved on very next day, when her serum lipase was 2000 U/L, serum amylase was 1500 U/L and serum triglyceride was 750 mg/dl. Then we started Fanofibrate, atorvastatine, omega 3 fatty acid for dyslipidaemia. On day 07 she fully recovered from her symptoms and was discharged with proper medication with advice.
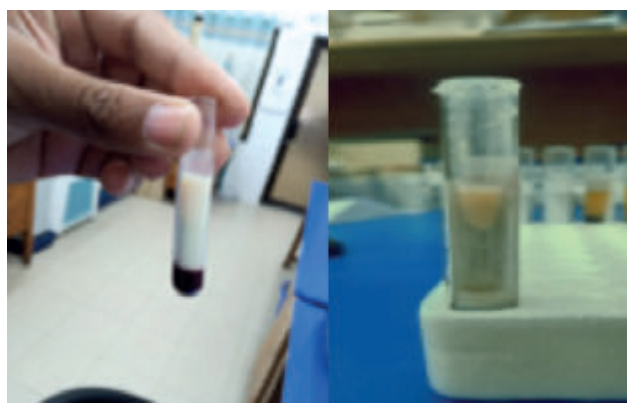

Fig: Lipemic Serum of the patient

Discussion: When inflammation of pancreas develops suddenly and may become life threatening, it is called

acute pancreatitis. The incidence is 40 per 100000 people in United States, so it is one of the leading causes of hospitalization of a patient in United States as well as other countries[2]. Mostly hypertriglyceridaemia induced acute pancreatitis occur in patient with type I, III, IV and V hyperlipoproteinaemia of Friedrickson's classification; which is primary or genetic factor of hypertriglyceridaemia. Primary hypertriglyceridaemia occurs in less than 5% cases and during this type serum triglyceride usually goes above 2000 mg/dl[3]. The secondary causes are diabetes mellitus, obesity, hypothyroidism, alcoholism, excess carbohydrate consumption, different types of hormone replacement therapy and antihypertensive drugs etc[3]. Though the secondary causes of hypertriglyceridaemia is not strong enough to increase serum triglyceride level above normal to cause acute pancreatitis, it is mandatory to rule out the causes as it will be helpful for further management of the condition[5]. The actual pathogenesis of hypertriglyceri-daemia induced acute pancreatitis is not confirmed 1 but it is hypothesized that; When the triglyceride level is high, it may accumulate in the pancreas and interact with pancreatic lipase in capillaries, which causes breakdown of triglyceride and form free fatty acid[1]. This causes generation of toxic level of free fatty acids and glycerols which triggers inflammation by tissue injury and leads to acute pancreatitis 1 & 6. Another hypothesis is; acute inflammation of pancreas by chylimicrons[3]. As chylomicrons are triglyceride rich lipoprotein, when serum triglyceride is > 900mg/dl; we will found chylomicrons in the circulation. They are larger enough to block the pancreatic capillaries, which can lead to ischemia and release of pancreatic lipase; that causes lipolysis and releases of free fatty acids which results release of different free radicals. These free radicals causing pancreatic injuries, as a result of all these events "acute pancreatitis" occurs[3].

In our case, patient presented with acute abdominal pain at epigastric region with high serum lipase- amylase level and high triglyceride level; initially these points triggered us to diagnosed the case as "hypertriglyceridaemia induced acute pancreatitis". This diagnosis was confirmed by ultra-sonoghraphic findings of swollen pancreas with peri-pancreatic fluid. We suspected that she had primary hypertriglyceridaemia as she has family history and other secondary reasons were ruled out. But she also had history

of irregularity in taking medication, as a result her triglyceride was that much high (2400 mg/dl), which caused inflammation of pancreas and presented as acute abdomen. In the case report of Suni K. Kota et al, their patient was a case of recurrent acute pancreatitis due to hypertriglyceridaemia (2080 mg/dl)[3]. Ahmed A Khalifa et al did a case report of 22 year old female patient who presented with severe hypertriglyceridaemia induced pancreatitis, where her triglyceride was 1335 mg/dl and amylase was 209 U/L. They tried to manage their case with plasmapharesis as she developed disseminated intravascular coagulation (DIC), acute renal failure and acute respiratory distress syndrome (ARDS)[7].

In managing a case of hypertriglyceridaemia induced pancreatitis, the level of serum triglyceride is very crucial as there is no clear guidelines for management of this condition exclusively based on triglyceride level. Different case reports reveled that hypertriglyceridaemia induced acute pancreatitis required insulin infusion, heparin therapy or plasmapheresis to lower triglyceride level and to prevent progression of the acute condition to necrotizing pancreatitis[2].

Conclusion: Hypertyriglyceridaemia and acute pancreatitis; both are very common medical conditions that we face in regular medical practice. The combination of this duo is less common but the result of their co-presence is critical as life threatening complication like DIC, ARDS or multi-organ failure can occur from acute pancreatitis. So, it is important to consider the rarest cause also during diagnosis of acute pancreatitis. An early accurate diagnosis of this condition with finding out the exact cause behind it can prevent many life risking complication of acute pancreatitis.

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Abstract From Current Literature

Environmental Nois e Exposure and Learning Performance of Secondary School Students

Samiha Kaisar, Farhana Ferdaus,
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Abstract

Background: Noise, inappropriate temperature, insufficient light, overcrowded classes, misplaced boards and inappropriate classroom layout all could be confounding variables distracting students in class. The objective of the study to emphasizes on the effects of classroom noise on student's learning performance, students' perception on noise, internal and external noise levels.

Materials and methods: This cross sectional study was conducted from January to December 2018 to assess any relationship between environmental noise level and learning performance of secondary school students, evaluation of various noise descriptors such as L10, L50, L90, Leq, and NC was measured with a smartphone using calibrated sound level meter app. The population of the study included students from class seven to class ten of the academic year 2017-2018 in Dhaka, of whom 580 students from three schools were selected by systematic random sampling.

Results: Among the participants 66.6% were male and the rest 33.4% were female aging from 13 to 16 years. In school-2, students of class seven were exposed by highest level of sound 81.08 dB and lowest level was 73.55 dB in class eight classroom. In school-1, highest level of sound was 77.69 dB in class seven and lowest level was 75.99 dB in class nine. In school-3, highest level of sound was measured 78.72 dB in class eight and lowest level was 75.03 dB in class nine.

Conclusion: Younger secondary school children appear to be more affected by noise than older students.

Exploring the Determinants of Malnutrition among Under-Five Children in the Coastal Area of Bangladesh

Farhana Ferdaus, Mahmuda Islam Bonna, Reshma Akter, Samiha Kaisar, Refat Zahan, Ruma Parvin, Sharmin Mostafa

Abstract

Background: This study discusses the issue of malnutrition among children under five in Bangladesh, particularly in the coastal areas where poverty and food insecurity are prevalent. Despite some progress, malnutrition remains a major cause of morbidity and mortality in these regions.

Materials and methods: The study presents the results of a cross-sectional study that investigated the nutritional status of children under five and the significance of family income in relation to several socio-demographic aspects that could impact children's nutritional condition.

Results: The study found that 40.47% of the children were wasted, 42.85% were stunted, and 50% were underweight. The multivariate analysis found that the mother's education, the socio-economic status of the family and the disease within the last 6 months had a significant association with the nutritional status of under 5 children. The study showed a significant correlation between a mother's education and a child's nutritional status, as well as household socioeconomic status.

Conclusion: The research concludes that without taking precautions to address undernutrition and micronutrient deficiencies, human development is not possible and poverty, food insecurity, ignorance, a lack of proper feeding practices, infectious diseases, and poor hygiene and sanitation are the main factors contributing to high rates of maternal and child undernutrition in developing nations.

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