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Chloramphenicol Overview in Eye Infections



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ABSTRACT

Since 1995, the UK has been reviewing the safety of ophthalmic chloramphenicol after a British Medical Journal letter recommended that its usage be stopped. This review evaluates the safety, efficacy, and economic aspects of ophthalmic chloramphenicol based on extensive research from American, European, and British studies dating back to 1950. The aim is to provide guidelines for safe usage and caution against hasty changes in antibiotic prescribing practices. This is because major practice changes could have a negative impact on departmental or practice drug budgets, increase the risk of treatment failure, and force patients to pay for repeat prescriptions. The need for complete accountability in nursing practice, in particular It is stressed when nurses use Trust guidelines to provide medication. The paper provides guidelines for nursing practice when ophthalmic chloramphenicol is provided in accordance with protocol and makes clear the necessity for nursing practice to be carefully thought out and founded on up-to-date, reliable research.



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1. INTRODUCTION:

A drug called chloramphenicol is used to treat and manage superficial eye infections such as otitis externa and bacterial conjunctivitis. It has also been used to treat cholera and typhoid. As an antibiotic, chloramphenicol belongs to the group of drugs known to prevent the creation of new proteins. This activity describes the use of chloramphenicol as a useful treatment for typhoid fever, otitis externa, superficial eye infections, and other serious, potentially fatal illnesses, particularly those brought on by *Haemophilus influenzae*. In order to help members of the healthcare team manage patients with the aforementioned infections, this activity will highlight the mechanism of action, adverse event profile, and other important factors (e.g., off-label uses, dosing, pharmacodynamics, pharmacokinetics, monitoring, and relevant interactions).

2. OBJECTIVES:

1. To determine chloramphenicol's mode of action and appropriate dosage.
2. To explain the side effects and guidelines for avoiding them.
3. To discuss proper monitoring for chloramphenicol toxicity.
4. To provide strategies for enhancing communication and care coordination among the healthcare team.

A synthetically produced broad-spectrum antibiotic is chloramphenicol. It was the first synthetic antibiotic to be manufactured in large quantities and was first identified in 1948, following the emergence of *Streptomyces venezuelae* bacterium. [1] Nevertheless, because of its well-known serious side effects, including bone marrow poisoning and grey infant syndrome, chloramphenicol is not frequently prescribed in the US.

Its use is indicated for otitis externa and bacterial conjunctivitis, a superficial eye infection. Additionally, it is reserved for cases of severe infections like rickettsial illnesses, typhoid fever brought on by serotype of *Salmonella enterica* Typhi, meningitis brought on by *Streptococcus*, *Neisseria meningitidis*, or *Haemophilus influenzae pneumoniae*. [2][3][4][5] Additionally, cholera can be treated with it. [6] Preoperatively, ointments containing chloramphenicol are also used.

as prevention of infections from surgical wounds. When undergoing eye and plastic surgery, this therapy is frequently required.[7][8]

Nevertheless, despite these benefits, Starting chloramphenicol should only be done in situations where a known medication susceptibility exists. and when less potent antimicrobials are either ineffective, intolerable, or contraindicated. Additionally, in vitro sensitivity testing must be carried out in order to stop the drug as soon as another, less harmful antimicrobials show therapeutic efficacy.

3. Action Mechanism:

EF Although chloramphenicol is bacteriostatic, at high quantities it may become bactericidal. This antibiotic has a broad spectrum of action, making it effective against both anaerobic and Gram-positive bacteria.[9][10]

Chloramphenicol inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit, preventing peptide bond formation and ultimately leading to bacterial cell death.[11] Additional antibiotics that further attack the ribosomal subunit 50S are macrolides like erythromycin and clarithromycin, as well as clindamycin, a lincosamide. These medications function differently, though. Chloramphenicol prevents transfer RNA from attaching to the 50S ribosome's A site at the molecular level. On the other hand, macrolides obstruct the tunnel that nascent peptides escape, while A and P are affected by lincosamides. sites.[12]

4. Administration:

Chloramphenicol is able to applied topically as an ointment for the eyes or ears or as eye drops. It can either be taken orally as capsules or administered parenterally as an injection or infusion given intravenously. Clinicians should administer therapeutic doses of chloramphenicol not to exceed 50 mg/kg/day, divided into doses and given at 6-hour intervals, due to the drug's significant risk of side effects and toxicity. In cases of serious infections brought induced by organisms that are moderately resistant, this dosage may need to be increased to 100 mg/kg/day. If a dosage increase of this kind is necessary, It is essential to closely monitor the patient and to reduce the dosage as soon as feasible to 50 mg/kg/day.

Additionally, patients with impaired hepatic or renal function, as well as neonates, may require dose decreases to 25 mg/kg/day. If taken intravenously, it must be diluted with either

5% glucose or 0.9% sodium chloride solution and given sporadically. Chloramphenicol should not be used for extended periods of time by clinicians.

Topical Administration	Systemic Administration
Topical administration involves applying a medication directly to a specific area on the surface of the body.	Systemic administration involves delivering a medication so that it enters the bloodstream and is distributed throughout the body to reach various tissues and organs.
Common forms include creams, ointments, gels, patches, and sprays.	Common forms include oral tablets or capsules, injections (intravenous, intramuscular, subcutaneous), and inhalation.
Localized to the application site with minimal systemic absorption.	Affects the entire body or a broad range of tissues.
Directly applied to the skin or mucous membranes.	Administered via oral, injectable, or inhalation routes to achieve widespread distribution.
The medication is intended to affect only the area to which it is applied, such as the skin, eyes, ears, or mucous membranes.	The medication affects the entire body or a specific organ system rather than just the site of administration.
The drug primarily acts locally, although some degree of absorption into the bloodstream can occur, potentially leading to systemic effects.	The drug is absorbed into the bloodstream and then transported to the site of action.
Examples: <ul style="list-style-type: none"> • Dermatological treatments: Creams for eczema, psoriasis, or acne. • Ophthalmic preparations: Eye drops for conjunctivitis. • Nasal sprays: For congestion or allergies. • Transdermal patches: Nicotine patches for smoking cessation, where systemic effects are also intended. 	Examples: <ul style="list-style-type: none"> • Oral medications: Antibiotics for infections, antihypertensives for high blood pressure. • Injections: Insulin for diabetes (subcutaneous), chemotherapy for cancer (intravenous). • Inhalers: Bronchodilators for asthma.

Topical Administration

Specific Examples:

1. Dermatological Treatments:

- **Hydrocortisone Cream:** Used for inflammation and itching caused by eczema, psoriasis, or allergic reactions.
- **Benzoyl Peroxide Gel:** Commonly used for acne treatment to reduce bacteria and dry excess oil on the skin.

2. Ophthalmic Preparations:

- **Timolol Eye Drops:** Used to reduce intraocular pressure in glaucoma.
- **Artificial Tears:** For dry eyes, providing lubrication.

3. Nasal Sprays:

- **Fluticasone Nasal Spray:** For allergies, reducing inflammation and nasal congestion.
- **Oxymetazoline Spray:** Used as a decongestant for short-term relief of nasal congestion.

4. Transdermal Patches:

- **Nicotine Patches:** Aid in smoking cessation by delivering nicotine through the skin.
- **Fentanyl Patches:** Provide long-term pain relief for chronic pain patients.

Systemic Administration

Specific Examples:

1. Oral Medications:

- **Amoxicillin:** An antibiotic used for treating bacterial infections such as strep throat and sinusitis.
- **Metoprolol:** A beta-blocker used to manage hypertension and heart conditions.

2. Injections:

- **Insulin:** Administered subcutaneously for blood sugar control in diabetes.
- **Methotrexate:** Given intramuscularly or intravenously for rheumatoid arthritis or certain types of cancer.

3. Inhalers:

- **Albuterol:** A bronchodilator used for acute asthma attacks or chronic obstructive pulmonary disease (COPD).

- **Fluticasone/Salmeterol (Advair):** A combination inhaler used for long-term management of asthma or COPD.

5. Adverse Effects:

When taken systemically, chloramphenicol is linked to serious hematological adverse effects. Chloramphenicol has been linked to fatal cases of aplastic anemia since 1982; taking it with cimetidine may increase this risk. This unfavorable side effect, it is probably caused by the drug's systemic absorption following topical treatment, might happen even when the medication is administered topically.[13][14] Blood dyscrasias caused by chloramphenicol can be divided into two categories. The first kind is more prevalent and is dose-related, reversible, and predictable. Along with neutropenia and thrombocytopenia, it results in moderate anemia. After pancytopenia sets in, the second type of reaction is a peculiar response. with a later onset that is probably going to be lethal. This kind is dose-independent, unpredictable, and irreversible.[15]

The depletion of ferritin levels within mitochondria appears to be the cause of aplastic anemia due to the fact that bacteria and mitochondria share ribosomal structures, which makes the latter vulnerable to the drug's capacity to prevent the creation of proteins inside the mitochondria.[15]

Leukemia has also occasionally developed following aplastic anemia from using chloramphenicol. [16] Chloramphenicol side effects include ototoxicity when applied topically as ear drops, gastrointestinal responses such as oesophagitis when taken orally, neurotoxicity, severe metabolic acidosis, and One of the fatal consequences of bone marrow suppression on plastic anemia.[17][18][19][18][17][20]

The most frequent neurotoxic side effect that might result from using chloramphenicol is optic neuritis. [21] This side effect typically takes longer than six weeks to show symptoms. Acute or subacute vision loss may be present, along with potential fundal abnormalities. Peripheral neuropathy, which can manifest as tingling or numbness, is another possible presentation. If optic neuropathy develops, the medication should be stopped right away. This will typically result in either a full or partial recovery of vision.[22]

Adverse effects of medications can be organized by type (local vs. systemic) and severity (mild, moderate, severe). Here's a structured overview:

Topical Administration		
Local Adverse Effects (at the site of administration)		
Mild	Moderate	Severe
<ul style="list-style-type: none"> • Pain at injection site • Mild swelling or redness • Mild bruising 	<ul style="list-style-type: none"> • Injection site reactions (e.g., moderate swelling, induration) • Phlebitis (inflammation of the vein) 	Severe local reactions (e.g., necrosis, abscess formation)
Systemic Administration		
Local Adverse Effects (at the site of administration)		
Mild	Moderate	Severe
<ul style="list-style-type: none"> • Pain at injection site • Mild swelling or redness • Mild bruising 	<ul style="list-style-type: none"> • Injection site reactions (e.g., moderate swelling, induration) • Phlebitis (inflammation of the vein) 	<ul style="list-style-type: none"> • Severe local reactions (e.g., necrosis, abscess formation)
Systemic Adverse Effects		
Mild	Moderate	Severe
<ul style="list-style-type: none"> • Nausea • Mild headache • Fatigue • Mild gastrointestinal discomfort 	<ul style="list-style-type: none"> • Dizziness • Diarrhea • Muscle pain • Elevated liver enzymes 	<ul style="list-style-type: none"> • Severe allergic reactions (e.g., anaphylaxis) • Organ toxicity (e.g., hepatotoxicity, nephrotoxicity) • Severe gastrointestinal effects (e.g., ulceration, bleeding) • Cardiotoxicity (e.g., arrhythmias, heart failure) • Neurotoxicity (e.g., seizures, neuropathy)

Examples of Adverse Effects by Medication Type

Topical Medications

1. Hydrocortisone Cream:

- **Mild:** Skin irritation, dryness
- **Moderate:** Contact dermatitis
- **Severe:** Systemic absorption leading to adrenal suppression (rare)

2. Benzoyl Peroxide Gel:

- **Mild:** Dryness, redness, peeling
- **Moderate:** Severe irritation, allergic reaction
- **Severe:** Rarely systemic effects like headache

Systemic Medications

1. Amoxicillin:

- **Mild:** Nausea, diarrhea, mild rash
- **Moderate:** More severe gastrointestinal upset, moderate allergic reaction
- **Severe:** Anaphylaxis, severe skin reactions like Stevens-Johnson syndrome

2. Insulin:

- **Mild:** Injection site pain, mild hypoglycemia
- **Moderate:** Moderate hypoglycemia requiring intervention, lipodystrophy at injection site
- **Severe:** Severe hypoglycemia leading to unconsciousness or seizures

6. Contraindications:

The use of chloramphenicol is strictly prohibited in patients with acute porphyria. [23][24] Furthermore, the use of alternative antimicrobials should be justified in cases with known hypersensitivity to chloramphenicol, such as prior anaphylactic reactions to the medication. Anaphylactic reactions to the drug can manifest as urticaria, bronchospasm, and edema.[25]

There have also been reports of delayed onset hypersensitivity responses, including contact dermatitis. This reaction frequently manifests as edema and erythema 24 to 72 hours after the drug is applied.[26] Furthermore, chloramphenicol should not be provided to neonates younger than one week old, especially preterm newborns, due to the possible risk of toxicity to these patients. It is currently categorized as a category C pregnancy medicine, meaning that taking it while pregnant or nursing is advised to be avoided. Nonetheless, some research

indicates that using chloramphenicol in the first trimester of pregnancy is not linked to teratogenicity.[27]

7. Monitoring:

When administering the medication parenterally or orally, it is important to keep an eye on the drug's plasma concentrations, particularly in the elderly, young children under four, and people with liver impairment. Chloramphenicol's therapeutic range is typically between 15 and 25 mg/L.[30] Additionally, while taking the medication, baseline and routine blood work should be done. A complete blood count, urea and electrolyte tests, liver function tests, and renal function tests are among these blood tests.

Before beginning the medicine, female patients should have their pregnancy tested. Aplastic anemia symptoms and indicators should also be explained to patients, and they should be urged to report any symptoms that arise while receiving treatment. These symptoms and indicators include paleness, severe fatigue, bruising easily, petechial rash, bleeding gums or epistaxis, and a higher risk of infection.

8. Toxicity:

Overdosing on chloramphenicol can be lethal; this usually happens when the drug is administered intravenously, and it is more likely to harm young children. Poisoning symptoms include vomiting and nausea, distension of the abdomen, metabolic acidosis, hypotension, hypothermia, collapse of the cardiovascular system, and coma. Chloramphenicol poisoning in newborns is known to cause grey baby syndrome, which primarily affects premature neonates. Breastfed infants whose mothers are taking oral chloramphenicol may potentially be affected. Because their immature liver cannot manufacture enough UDP-glucuronyltransferase enzyme to metabolize chloramphenicol via glucuronidation for renal excretion, preterm neonates are more likely to be harmed. Gray baby syndrome is the consequent build-up of chloramphenicol in the baby.

Grey baby syndrome symptoms can differ according on the drug's serum levels in the body. Poor eating, irritability, vomiting, abdominal distension, grey skin discolouration, and abrupt collapse due to respiratory and cardiovascular issues are a few instances of poisoning signs and symptoms. Because newborn exposure to chloramphenicol carries a potential risk of

death, nursing moms should always explore other medication options. If chloramphenicol is the treatment option chosen, the baby must be closely observed.

9. Enhancing Healthcare Team Outcomes

As with any drug, an interdisciplinary healthcare team will be needed to prescribe chloramphenicol safely and ensure that patients receive the most benefit from its treatment. The physicians, nurses, and pharmacists on this multinational medical team will be providing patient care. The doctor should always obtain a complete medication history from the patient before starting an antibiotic in order to rule out any possible allergies to chloramphenicol. Additionally, nurses can assist female patients who are of childbearing age in getting a pregnancy test and having a negative pregnancy status verified before starting medication.

In order to ensure that the patient is receiving the drug at the proper dose, route, and frequency, the pharmacist might collaborate with the doctor. The doctor and the pharmacist should also look for concurrent use of other medications that may carry the risk of lowering blood cell counts because using chloramphenicol might decrease bone marrow. Medications such as trimethoprim, carbimazole, and rifampicin can also reduce bone marrow. Chloramphenicol should not be taken with any of these drugs.

Nurses providing patient care can work with doctors to make sure lab tests are run frequently throughout the course of treatment in order to detect drops in blood cell counts early. Finally, it is the duty of doctors, nurses, and pharmacists to ensure that patients receive sufficient information about the medication. Patients should be aware of the warning signs and symptoms of a chloramphenicol adverse reaction so they can report it. It might also be beneficial to properly educate patients on the use of chloramphenicol. increase the adherence of patients to their medicines.

10. CONCLUSION:

Chloramphenicol is an antibiotic that is commonly used to treat eye infections such as conjunctivitis and keratitis. It works by stopping the growth of bacteria in the eye, helping to clear up the infection. However, it is important to use chloramphenicol eye drops as prescribed by a healthcare professional and to follow the recommended dosage and duration of treatment. Overuse or misuse of chloramphenicol can lead to antibiotic resistance and potential side effects such as irritation, allergic reactions, or rarely, aplastic anemia.


Therefore, it is crucial to use chloramphenicol eye drops responsibly and to seek medical advice if any concerning symptoms occur during treatment.





Prolonged use of chloramphenicol eye drops should be avoided as it may increase the likelihood of sensitisation and emergence of resistant organisms. If any new infection appears during the treatment, the antibiotic should be discontinued and appropriate measures taken.

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