JOURNAL OF CLINICAL PHARMACY IN COMMUNITY PRACTICE

JOURNAL OF CLINICAL PHARMACY IN COMMUNITY PRACTICE (JCPCP)

AIMS AND SCOPE

The journal focuses on publishing case studies with the flavours of clinical care. The cases are expected to relate patient subjective and objective data with drug use alongside the outcomes with insights of pharmaceutical care. A careful exposition of the drug delivery, pharmacokinetics, biopharmaceutics, therapeutics and drug molecular structure effects.

PUBLISHERS

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GUIDE TO AUTHORS

PHARMACEUTICAL CASE REPORTS

The Journal of Clinical Community Pharmacy Practice ((JCPCP) aims at prompting pharmacists in the healthcare, at the community pharmacy/primary healthcare practice levels, to demonstrate knowledge and understanding of the application of therapeutics in clinical practice.

Pharmacists are not usually at home with case studies in many developing countries. A Pharmacy Case Study (PCS) or case study in pharmacy presents a description of the activities/responsibilities of the clinical pharmacists and highlights the challenges and opportunities of that setting.

The underlying idea of publishing these case reports is to meet the needs and challenges of modern pharmaceutical care as well as in postgraduate education/training. The case reports will also help pharmacists to ensure client safety and achieve desired health outcomes through effective decision making.

Clinical Pharmacy services have evolved rapidly and have been developed to cover a wide range of client care settings and therapeutic areas. The activities can be presented as
Critical instance case study
Cumulative case study
Explorative case study
Illustrative case study (Primarily descriptive).

The features will span cases of drug use in:

1. Respiratory System
2. Cardiovascular System
3. Chronic Obstruction Pulmonary Disease (COPD) with co-morbidity
4. Obstetrics and Gynaecology
5. Urinary tract Infection
6. Liver Disease
7. Neurology Disease
8. Psychiatry
9. Cancer
10. Gastrointestinal
11. Others.

JCPCP is a double-blind peer-reviewed International journal dedicated to the publication of case studies.

JCPCP is an official publication of Bioscientific Research Group domiciled at Department of Clinical Pharmacy and Biopharmacy, Faculty of Pharmacy, University of Uyo, Nigeria. The objectives of the support organization, Bioscientific Research and Development (BIOSCIRD) Ltdgte are mentoring, nurturing and encouraging of practitioners in the study and practice of

pharmaceutical, clinical, analytical and biomedical sciences, and to promote professional interaction among pharmacists/clinicians/scientists across the globe.

This journal is peer-reviewed by seasoned clinicians/consultants as quarterly published volumes in online and print formats. It is committed entirely to pharmaceutical case studies and presents cases in a systematic and interesting manner so that clinicians can replicate successful outcomes.

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All these three conditions must be met. Each author is expected to have participated sufficiently in the work to take responsibility for appropriate portions of the content.
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Guidelines for Pharmaceutical Case Reports

Steps to Writing a proper Pharmacy Case Study
Identify your objective and the goal in the writing. What is this case study out to help with? Any intervention that should be amplified? Choose your client or subject from the available list based on the interventions that are worthy of note.
Conduct research, compile data. Data to focus more on drugs (dosage form used, excipients employed in the dosage form (if any), physicochemical properties of the drugs as these factors affect the clinical response and other outcomes from the clients
Write your case study. Promote the story by publishing it

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Prepare the manuscripts in MS word doc (2003 or higher versions), Times New Roman font with a size of 12 and 1.5 line spacing in A4 format.

Manuscript should be arranged in the following order; Title page (20) , Authors names and affiliations, Abstract (100), Key words (5), Introduction (200), Number of Encounters (20), Medical History (50), History of Present illness (100), Current complaint/presentation (100), Other Diseases/Co-morbidity (50), Familial and HEAD-SU (50), Surgical History(50), Allergies (50), Client Current Medications (200) (a. Synthetics b. natural products, Clients Nutritional Intake (a. dietary products b. Regular intake c. occasional intake) Lifestyle (100) (Professional, Social and Religious) (100), Social and Family History(50), Physical Examination (200)(Vitals, General, Cardiovascular, Respiratory, Gastrointestinal etc, Laboratory Investigations (pharmacist-ordered) (200), Pharmaceutical Audits: (300) (Drug-Disease Audit, Drug-Drug Audit, Drug-Food Audit, Drug-Laboratory Outcome Audit (100), Decision to dispense or otherwise of Drugs: Dispense-a (reasons) or Hold back-b (reasons) if the pharmacist is not the original prescriber, Drug Therapy Problems Observed (50),Pharmaceutical Intervention (Reasons for intervention/suggestions for resolution), Pharmaceutical Care Goals (50), Pharmaceutical Care Plans (50), Ensuing Drug Recommendation/Prescription (50), DISCUSSIONS Biopharmaceutics (Physicochemical and pharmaceutics exposition of drugs in this case) and Pharmacology (200), Pharmaceutical Primary Intervention (50), (If subsequent visits) Pharmacist's Subsequent Assessment (50), Comments and Laboratory Outcome, Patient Self Evaluation Report (50), Non-Pharmacologic Advice (200)(a. Lifestyle b. Monitoring parameters for progress c. Seeking/Needing Medical Advice/Attention) (100), Conclusion (50), Data Availability (20), Conflict of Interests (20); Acknowledgement (50), and References (Minimum 15-Maximum 25). Please see a prototype submission below

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Books: Rang HP, Dale MM, Ritter JM, Moore PK. Pharmacology. 5th ed. Churchill Livingstone: Elsevier; London, 2003.p.693. Doi.10/ghdale-rang

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JCPCP

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GUIDE TO AUTHORS

Pharmaceutical care and management of diabetes mellitus with foot ulcer: a case report

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ABSTRACT

Diabetes stands as the primary cause of non-traumatic lower extremity complications. This case report underscores the management of a 67-year-old geriatric female diabetic client presenting with a chronic foot ulcer (FU). A comprehensive evaluation encompassed the client's medical history, current symptoms, medication regimen, and lifestyle factors. Pharmaceutical interventions focused on optimizing antibiotic therapy and implementing recommended wound care strategies. Consistent follow-up assessments tracked the patient's progress, revealing marked improvement and underscoring the critical role of integrated pharmaceutical care in diabetic FU management

KEYWORDS: Diabetes, Foot ulcer, Pharmaceutical intervention, Optimizing therapy, Wound care strategies

INTRODUCTION

Diabetic foot ulcers (DFUs) pose a significant complication of diabetes, often resulting in prolonged hospital stays, increased healthcare expenses, and diminished quality of life [1-3]. Globally, DFUs present major health challenges, causing considerable suffering, significant mortality rates, and substantial healthcare expenditures [3, 4]. There is limited literature on individual pharmaceutical cases of diabetes in the elderly.

Despite advancements in wound care, DFUs remain a formidable challenge, requiring a multidisciplinary approach to achieve successful outcomes [4]. Managing diabetes in older adults is complex and frequently complicated by foot disorders, including peripheral neuropathy, foot deformities, and peripheral arterial disease (PAD) [5]. Additional risk factors such as gait abnormalities, reduced mobility, and other medical conditions contribute to the heightened risk of major amputations with advancing age. Moreover, the prevalence of neuropathy, foot deformities, and PAD increases with age, even among non-diabetic individuals [6].

Current community pharmaceutical care underscores the crucial role of pharmacists in optimizing therapy and averting complications through medication management in diabetic DFUs [7]. This case report delineates the management of a diabetic patient with a non-healing foot ulcer, highlighting the integral role of pharmaceutical intervention in community settings."

METHODOLOGY/OBSERVATIONS

Nature of Encounter

Presented here is a multi-session exploratory case report of DT, a 54-year-old African descent female.

Medical History

DT has been managing type 2 diabetes mellitus (T2DM) for a decade, experiencing challenges in maintaining optimal glycaemic control despite consistent adherence to oral hypoglycaemic agents. Over the past five years, she has been hospitalized twice due to complications related to blood sugar management at a tertiary hospital in her state of residence.

Medication History

During DT's upbringing, she received various medications, both prescribed and unprescribed, for minor ailments, and did not recall the dosages until she was diagnosed in a hospital years ago and started on her current regimen of medications.

History of Present Illness

DT has experienced fatigue, polyuria, and polydipsia for several months prior to visiting the pharmacy. Her neighbors offered suggestions for managing her superficial foot ulcer (which first appeared approximately 7 months ago) and she has used multiple types of wound dressings without significant improvement. At the start of the study, DT presented with elevated fasting blood glucose levels (367 mg/dL) and expressed serious concern about her condition.

Current Complaint or Presentation

Upon initial presentation at the facility, the patient (DT) reported symptoms of polyuria and polydipsia, accompanied by profound fatigue. Additionally, she expressed discomfort related to her chronic foot ulcer (FU), which she attributed to impair her ability to perform her occupational and domestic duties as a wife and mother of four children. The clinical pharmacist conducted an assessment, noting a malodorous wound, indicative of suboptimal prior management."

Other Diseases/Co-morbidity

There are no apparent underlying pathological conditions contributing to the current condition

Familial and HEAD-SU

The patient's family history is significant for type 2 diabetes mellitus (T2DM) in both deceased parents. However, she denies any personal history of hypertension, epilepsy, asthma, or sickle cell disease. Additionally, there is no reported family history of gastrointestinal lesions or ulcers.

Surgical History

None reported

Allergies

There are no reported allergies or sensitivities to foods, medications, or environmental factors."

Client's Current Medications

Synthetic drugs

Metformin 1000 mg twice daily; Ampicillin-Cloxacillin (Ampiclox) capsules 500 mg twice daily per oral; Multivitamin capsules (Alphabetic) one tablet daily; Trichlorophenol (TCP) dressing twice daily; Chloramphenicol capsules as powder for wound dressing.

Natural products

Honey as dressing for wound

Client's Nutritional Intake

Special intake

No special meal type adopted

Regular intake

Balanced diet with fairly reduced carbohydrate intake

Occasional intake

Pastries and ice cream once in a long while

Client's Lifestyle

Professional

DT had an office job previously and recently some form of post-retirement sedentary lifestyle as a trader

Social

Moderate social interactions now compared to previous regular parties and social function engagements.

Religious

Engages in religious practices regularly, occasional fasting and night vigils

Social and Family History

The client is married with four adult children. Family support is present.

Physical Examinations (*by pharmacist at first*)

Vital signs

Temperature 36.5°C **(36.1-37.2**); Blood Pressure 175/100 mmHg **(110-130/70-80);** Heart rate 82 beats/min **(60-100);** Respiratory rate 20 cycles/min **(12-16);** Body weight 66kg; Body mass index, 24 **s**

General Examinations

On examination, DT appeared ruffled about her present ailment

Cardiovascular system

No noticeable issues observed

Respiratory system

Clear breathing on observation

Gastrointestinal system

Unremarkable in presentation

Laboratory Investigation (Pharmacist-ordered)

Imaging tests

Ultrasonography

A circumscribed thickening of the gastric and duodenal walls with an echogenic centre exceeding 8mm (min allowed 5mm) was observed - an indication of gastroduodenal ulcer [8]

Biochemical tests

Random blood glucose (RBS) 367mg/dl (4h postprandial glucose)

Serology (HIV test) revealed negative result

Microbiological tests

Wound swab – revealed *Pseudomonas aeruginosa, Proteus mirabilis* and *Escherichia coli* sensitive to the fluoroquinolone antibacterial (cipfrofoxacin, ofloxacin and pefloxacin); Cephalosporin antibacterial (cefixime and cefpodoxime) and aminoglycoside antibacterial (gentamicin and streptomycin).

Pharmaceutical Audits

Drug-Disease Audit

Metformin 1g twice daily (2g daily dose, Maximun allowed 2.5g) appears too heavy for DT and requires dosage adjustment [9]. Doses above 500 mg taken on empty stomach increases gastrointestinal upset just as taking with meal reduces the bioavailability [10]. Reducing the size of a single dose of metformin and adding a sulphonylurea is expected to produce a better glycaemic control in T2DM [11].

The use of amlodipine 5mg in this case requires an increased dosage. The primary efficacy end point requiring a decrease of both systolic blood pressure (SBP) and diastolic blood pressure (DBP) will be achieved with titrating dose of drug higher in mild to moderate hypertension [12] There is also the need to add a supporting drug e.g., an angiotensin converting enzyme inhibitor, lisinopril or angiotensin receptor blocker, telmisartan to the regimen to protect the renal system from the high blood pressure levels is expedient.

Drug-Drug Audit

A review of the literature reveals no documented evidence of drug interactions between metformin and Ampiclox® (ampicillin and cloxacillin), which was previously used to manage the diabetic foot ulcer (FU). However, trichlorophenol (TCP) has been shown to exhibit carcinogenic potential in animal studies, suggesting the need for a safer alternative antiseptic. A replacement with a more tolerable antiseptic is recommended to minimize potential risks.

Drug-Food Audit

Metformin therapy is predicated on the assumption that lifestyle modifications, including dietary changes and regular exercise, are implemented concurrently for optimal efficacy. However, the client is not currently following a special diet. In general, a well-planned diet is sufficient for diabetes management, and its implementation is recommended to complement pharmacological interventions.

Drug-Laboratory Tests Outcome Audit

An elevated fasting blood sugar value was noted, suggesting that the current drug regimen and treatment strategy are not effectively managing the patient's blood sugar levels.

Drug-Lifestyle Audit

As previously mentioned, factors such as a sedentary lifestyle can impede the efficacy of metformin. Lifestyle biopharmaceutics highlights the impact of various lifestyle practices on drug disposition, and in this case, sedentary lifestyle may lead to slower metabolic clearance, potentially influencing drug levels and activity.

Decision to Dispense/Refill or otherwise of Drugs: *Dispense/Refill-a(reason) /Hold back-b (reasons) if the pharmacist is not the prescriber*

Not applicable as client already complied with regimen of previous prescription before the visit

Drug Therapy Problems Observed

High doses of metformin noted requiring attention

Ampiclox® with inappropriate dosing regimen noted requiring attention

Ampiclox® is also observed as an unnecessary drug

TCP is not the best drug for wound dressing in this circumstance

Pharmaceutical Intervention *(Reasons for intervention and suggestions for resolution etc)*

High doses of metformin- reducing the dose of single dose of metformin

Ampiclox® low dose- Removing the drug from the prescription Ampiclox® is an unnecessary drug-Removing

the drug from the line-up.
TCP is not the best drug for wound dressing- Debriding the wound and replacing with diluted Chlorhexidine (Savlon.®)

Pharmaceutical Care Goals

To resolve actual and potential drug – related adverse effects in SB

Pharmaceutical Care Plan

To audit the medications for incompatibilities
To recommend and implement medications for improved outcome
To design an appropriate follow-up protocols for the client

Ensuing Drug Recommendation/Prescription

Metformin 500 mg one twice daily` for 10 days
Glimepiride 4mg twice daily for 10 days
Ofloxacin 200mg two times daily for 10 days
Magnesium sulphate 2%w/v for dressing on alternate days
Bacitracin spray for daily dressing

DISCUSSIONS

Biopharmaceutics and Pharmacology

Metformin

Metformin, a biguanide and antihyperglycaemic agent, is considered a first-line therapy in the management of type 2 diabetes mellitus (T2DM) [14]. Its multifaceted mechanism of action involves direct and indirect effects on the liver, gut, and molecular levels. Metformin inhibits the mitochondrial respiratory chain in the liver, activating AMP-activated protein kinase (AMPK), which enhances insulin sensitivity through effects on fat metabolism [15]. Notably, metformin does not increase the risk of hypoglycemia [14]. As an "insulin sensitizer," it reduces insulin resistance and fasting blood glucose levels, as evidenced by clinical trials [Bailey]. Metformin is used adjunctively with diet and exercise to improve glycaemic control, reducing hepatic glucose production and intestinal glucose absorption while increasing peripheral glucose uptake and utilization [14]."
Metformin is rapidly distributed following absorption, with no binding to plasma proteins. It does not undergo biotransformation, as no metabolites or conjugates have been identified. The drug is eliminated renally, with a plasma elimination half-life of 4-8 hours [16]. Renal impairment significantly impacts metformin elimination, which correlates with creatinine clearance. Therapeutic levels of metformin range from 0.5-1.0 mg/L in the fasted state and 1-2 mg/L postprandially [16]. Common adverse effects of metformin include nausea, vomiting, stomach upset, diarrhea, weakness, and metallic taste [16].

Ampiclox®

The combination of ampicillin and cloxacillin (β-lactam antibiotics) in Ampiclox has been shown to significantly enhance efficacy against penicillinase-producing strains of common microorganisms [17]. BotH ampicillin and cloxacillin are bactericidal, with a similar mechanism of action to benzylpenicillin, but with a broader spectrum of activity, covering additional gram-positive and gram-negative organisms. They may exhibit synergism with aminoglycosides and β-lactamase inhibitors, such as clavulanic acid and sulbactam. However, the inappropriate use and steady abuse of Ampiclox in many settings have raised concerns about its effectiveness due to a lack of antimicrobial stewardship."Oral absorption of the antibiotics is affected by many factors including food hence its absorption and bioavailability have high variabilities [17].
Ampiclox exhibits stability in gastric acid and incomplete absorption from the gut following oral administration, with peak plasma concentrations (2-6 mg/L after a 500 mg dose) achieved within 1-2 hours. The drug is widely distributed, achieving therapeutic levels in soft tissues, ascitic, pleural, and joint fluids. Ampicillin has a low protein binding affinity (20%) and crosses the placenta, with detectable concentrations present in breast milk. Renal excretion occurs via glomerular and tubular routes, with a plasma half-life typically ranging from 1-2 hours, but prolonged in elderly individuals (up to 20 hours in renal failure patients). Metabolism is minimal, with approximately 20% of the dose (250-500 mg) metabolized by healthy subjects, and 7% of the total dose excreted as metabolites in urine within 12 hours [17].

Ofloxacin

Ofloxacin is a synthetic fluoroquinolone antibacterial agent indicated for the treatment of various bacterial infections, including respiratory tract, kidney, skin, soft tissue, and urinary tract infections. Its mechanism of action involves inhibiting the supercoiling activity of bacterial DNA gyrase, thereby halting DNA replication. Ofloxacin is primarily eliminated through renal excretion, with 65-80% of an administered oral dose excreted unchanged in the urine within 48 hours. Additionally, 4-8% of the dose is excreted in the feces, with minimal biliary excretion observed

Trichlorophenol

2,4,6-Trichlorophenol (TCP) is a chlorinated phenolic compound, which appears as a light yellow solid and is soluble in aqueous solutions. Historically, TCP was utilized as a fungicide and bactericide in medical applications [19].

Chloramphenicol

Chloramphenicol is an organochlorine compound, belonging to the classes of diols, C-nitro compounds, and carboxamides. Initially isolated from Streptomyces venequelae cultures in 1947 [20], it was later synthetically produced. Chloramphenicol exhibits a range of biological activities, including antimicrobial properties, protein synthesis inhibition, and geroprotection. Notably, it was the first broad-spectrum antibiotic to be discovered, with a relatively simple chemical structure [20]. Chloramphenicol is known to impair the metabolism of various drugs, including tolbutamide, chlorpropamide,

dicoumarol. Conversely, paracetamol (acetaminophen) has been reported to decrease the metabolism of chloramphenicol. Phenytoin and phenobarbitone have been shown to accelerate the elimination of chloramphenicol, likely due to enzyme induction. Additionally, mannitol, ethacrynic acid, hydrochlorothiazide, and clopamide increase the renal excretion of chloramphenicol, whereas frusemide (furosemide) decreases its renal excretion [20].

Peak chloramphenicol concentrations of 10 to 20 µg/ml and trough concentrations of 5 to 10 µg/ml are generally desirable for most infections [20]. Therapeutic concentrations depend on the sensitivity of the specific offending organism, in addition to the type and severity of infection. Concentration-dependent bone marrow suppression has been associated with sustained peak serum concentrations ≥ 25 µg/ml and trough concentrations ≥ 10 µg/ml. The 'grey syndrome' has been associated with chloramphenicol concentrations of ≥ 40 µg/ml [21].

Honey

Honey, a natural product with extensive therapeutic applications, has been analyzed to comprise approximately 200 constituents, primarily fructose and glucose. Additionally, it contains fructo-oligosaccharides, vitamins, minerals, various amino acids, and enzymes [22]. Research has consistently demonstrated the efficacy of honey in promoting wound healing in Diabetic Foot Ulcers (DFU). The treatment of DFU involves various approaches, including topical wound care applications, which often incorporate honey as a valuable component.

Pharmacist's Subsequent Assessment (*i.e., after a subsequent visit*)

The wound had reduced in depth and circumference with a good prognosis of healing after one week of post-intervention step.

Comment/Laboratory Outcome

Blood sugar level in the past one week, taken on alternate days were satisfactory (mean value 89mg/dl)

Similarly, haemoglobin level was 12.5 g/dl

Client's Self-Evaluation Report:

Client reported that she feels a lot better within her and she sleeps well and able to move around freely unlike her past status

Non-Pharmacological Advice

Lifestyle Counseling

Dietary control counsel was given concerning type and size of food for effective glycaemic control

Routine exercise around the house was advised to include brisk walking for 1 h twice daily (morning and evening).

Reduced salt intake was advised

Monitoring Parameters for Progress

Client is encouraged to have blood glucose checks and evaluating of values with meal types and meal times for proper choice and selection of meal appropriateness.

Body weight check was similarly advised

Seeking Medical Advice/Attention

In case of any consistent high blood sugar levels, client was advised to seek medical advice.

CONCLUSION

A comprehensive pharmaceutical management approach, encompassing medication adjustment, lifestyle modification, client education, and appropriate wound dressing, has yielded significant improvements in both glycaemic control and wound management in diabetic foot ulcers (DFU), as evident in this case study. This multifaceted approach has demonstrated effectiveness in promoting optimal outcomes in DFU patients.

ETHICAL CONSIDERATIONS

Data Availability

Further data are available on request from the corresponding author

Conflict of Interest:

None declared.

Compliance with Ethical Guidelines

The study complied with ethical guidelines for human research/study

Authors' Contributions

The authors confirm contributions as follows: study conception and design ABO; data collection ASO; Analysis and interpretation of results ASO and ABO; Draft manuscript preparation ADL; All authors reviewed the result and approved the final version of the manuscript

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A pharmaceutical case of NSAID-induced ulcer with gastrointestinal bleeding

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ABSTRACT

Non-steroidal anti-inflammatory drugs are widely prescribed and have known adverse effects on the renal and gastric mucosa. This case study presents NSAID-induced ulcer with gastrointestinal bleeding. Pharmaceutical care approaches were applied to evaluate drug use in the client. Pharmaceutical care protocols were deployed to manage the ulcer symptoms while and the presenting bleeding. Pharmaceutical counselling bothering on removal of exposure to over-the-counter OTC non-steroidal anti-inflammatory drugs (NSAIDs) was emphasized alongside abstinence from foods that provoke gastric acid secretion. Recommending medications to ameliorate the bleeding condition and managing the lesion produced a positive outcome.

KEYWORDS: NSAID, Ulcer, Gastrointestinal Bleeding, Pharmaceutical Care, Pharmaceutical care

INTRODUCTION

Non Steroidal Anti-Inflammatory Drugs (NSAIDs) are widely used for pain management but their association with gastrointestinal ulcers and bleeding is a recognized concern [1]. Most often prescriptions of NSAIDs precede the prescriber's knowledge of a latent gastrointestinal lesion [2]. Symptoms of peptic ulcer disease are variable and may include abdominal pain, nausea, vomiting, weight loss and bleeding or perforation with complicated disease [3]. This case outlines the challenges faced in managing a client with NSAIDs-induced ulcer.

NSAIDs probably damage the small bowel through cyclo-oxygenase (COX)-dependent and COX-independent pathways. COX-dependent pathway is mediated through inhibition of prostaglandin synthesis, leading to disruption of the small bowel mucosal barrier [4, 5].

Non-steroidal anti-inflammatory drugs (NSAIDs) account for 8% of prescriptions worldwide and are used most commonly in age over 65 years [6, 7]. Symptomatic upper gastrointestinal (GI) peptic ulcer disease and bleeding are the most recognised adverse events related to NSAIDs [8].

Misoprostol is effective against duodenal and gastric ulcer and bleeding. Furthermore, omeprazole will prevent both gastric and duodenal ulcers. Histamine-2-receptor antagonists will prevent duodenal but not gastric ulcers, and may reduce ulcer bleeding. The case study presents the pharmaceutical care approach to the case.

METHODOLOGY/OBSERVATIONS

Nature of Encounter

A multiple-encounter case study of JC, a 45-year-old female that presented with recurrent ulcer with bleeding

Medical History

The client, a history of recurrent peptic ulcer disease diagnosed about five years ago, now exacerbated very recently, by NSAIDs use prescribed for chronic back pain.

Medication History

Client had a significant record of drug use which included corticosteroids for weight gain in her teens. She also took high doses of multivitamins for the same purpose. After the first diagnosis of peptic ulcer, she had continued self-medication and followed recommendations from a couple of drug dealers in her community.

History of Present Illness

The client reported worsening abdominal pain, dark stools, and light headedness, indicating possible gastrointestinal bleeding.

Current Complaint and Presentation

Presenting with abdominal, lower back pain, dizziness, numbness/tingling in hands, tiredness, loss of appetite and irritability.

Further complaint included shortness of breath and fast heart beat.

Other Diseases/Co-Morbidity

The client denies other noticeable symptoms of diseases or co-morbidities.

Familial and HEAD-SU

JC has no familial history of hypertension and epilepsy. The maternal uncle died of complications of asthma and diabetes. None of the family line has sickle cell pathology.

Surgical History

Client has had myomectomy twice (11 and 6 years back)

Allergies

No known allergies involving medicine, food, or environment.

Client's Current Medications

Synthetics

Ibuprofen 400mg twice daily for 2 weeks
Cimetidine 400mg once daily for 2 weeks
Aluminum/Magnesium Hydroxide 20 ml as required

Natural products

An unregistered acclaimed potent antiulcer herbal remedy

Nutritional Intake:

Special intake

No special diet is adopted, only abstinence from selected spicy foods and carbonated drinks

Regular intake

Cereals such as rice, sorghum, maize with vegetables

Occasional intake

Pastries and ice-cream

Client's Lifestyle

Professional

The client is a self-supported student who also engages in trading and travels inter-state dealing on fabrics

Social

The client is an undergraduate student, a member of Rotary Club, and a Christian with no denominational preference.

Religious

The client admitted to a devoted Christian life after making a decision to this commitment

Social and Family History

The client quitted smoking six years ago, denies alcohol/illicit drug use, is in a monogamous relationship, employed in a bakery, and traveled to Mexico a year ago.

Physical Examination: (Performed by the Pharmacist and Pharmacist ordered laboratory-test)

Vital signs

Temperature 36.0°C (36.5-37.5); Heart rate 88 bpm (60-100); Respiratory rate 22 cc/min (**12-20**); BMI 28

(20-24.9)

General Examination

General appearance is unwell, anxious, with mild respiratory distress.

Skin and sclera appear pale.

Laboratory Investigations: (Pharmacist-ordered)

Imaging tests

Double contrast radiological imaging revealed benign ulcers located at the lesser curve measuring <2cm and of the posterior wall measuring >2cm of antrum (antral ulcers)

Biochemical tests

The following are outcomes of laboratory tests for the client: Malaria parasite test using microscopic protocols (+); Serology (HIV) Negative; Haemoglobin 8.9 g/dL (**12-16**); RBC 4.8 x 10^6 cells/mL (**3.8-5.2**); Mean Corpuscular Haemoglobin (MCV) 92 fL (**80 - 100**); Mean Corpuscular Haemoglobin Concentration (MCHC) 35g/dl (**32-36**); AST 30 IU/L (**8-33**); ALT 59 IU/L(**4-36**); AFP 15 ng/ml (**0-40**), GGT 22 IU/L (**5-40**); Total protein test 79 g/L (**60-83**); Faecal occult blood (FOB) test was positive.

Microbiological tests

No microbiological tests was ordered/performed

Pharmaceutical Audits

Drug-Disease Audits

The prescribed drugs are inadequate for the mitigation of the ailment. The prescribing of ibuprofen for pains in an ulcer condition will worsen the outcome therefore this should be removed.

Drug-Drug Audits

The currently filed drugs are compatible one with the other. There is need to space out the oral tablets from the Aluminium hydroxide may reduce the absorption of the co-administered medications.

Drug Laboratory Outcome Audits

Outcome of laboratory tests upon the use of the drugs indicated that there is need for build up of the body with haematinics and for the pathology to be arrested to avoid to prevent further loss of blood.

Decision to Dispense/Refill or otherwise of drugs a-Dispense/Refill- reasons b. Hold back- reasons if the pharmacists is not the original prescriber (23/100)

The drugs was dispensed with recourse to the prescriber on salient issues on drugs filed for re-consideration in addition to the recommended medications

Drug Therapy Problems Observed

Unnecessary Drug Use: NSAIDs in a client with a history of peptic ulcers.

Adverse Drug Reaction: Gastrointestinal bleeding due to NSAIDs.

Pharmaceutical Intervention (Reasons for the interventions /Suggestions for resolution

To resolve potential and actual drug therapy problem

Pharmaceutical Care Goals

Alleviate pain with safer analgesics. Prevent further gastrointestinal bleeding. To eradicate *H. pylori*.

Pharmaceutical Care Plans

To assess the therapeutic needs for the client. Develop client-specific management plans for the client. To direct client on the proper use of medications. To monitor outcomes of therapy on the client

Ensuing Drug Recommendation/ Prescription

Esomeprazole 20 mg tablet to be taken twice daily x 21 days

Celecoxib 200mg tablet to be taken 2 times daily x 21 days

Chymotrypsin tablets 2 tablets to be taken twice daily x 21 days

DISCUSSION

Drug Biopharmaceutics and Pharmacology

Esomeprazole

Proton-pump inhibitors (PPIs) represent a class of drugs most prominently known for their use in acid-related disorders. PPIs are derivatives of the heterocyclic organic molecule benzimidazole. They are often the first-line agents for the following diseases- eosophagitis, non-erosive reflux disease, peptic ulcer disease, prevention of non-steroidal anti-inflammatory drug-induced ulcers and Zollinger-Ellison Syndrome. PPIs may also be useful in conditions that may result in heavy NSAID use, such as acute coronary syndrome or chronic pain, as a preventative measure against NSAID-induced ulcers [10].

The parietal cells contain the H+/K+ ATPase enzyme, the proton pump that PPIs block. This enzyme serves as the final step of acid secretion into the stomach. Interestingly, PPIs are prodrugs activated only after undergoing an acid-catalyzed cleavage in the acidic secretory canaliculi of the parietal cells. Hepatic P450 enzymes degrade PPIs. While there are slight variations in the exact P450 enzymes that are dominant in the degradation of the variety of PPIs, most dominantly degrade by the action of CYP2C19 [11].

Understanding the metabolism of PPIs explains the reason some PPIs work better for some individuals than others. Furthermore, the bioavailability of PPIs increases with age, thus dosages in the elderly should also be closely monitored and adjusted accordingly. While other drugs can reduce acid secretion in the stomach, PPIs represent the most potent drugs [12].

The drug formulation of PPIs is often specifically designed to prevent premature activation by gastric acid. The delivery methods include: enteric-coated tablets, gelatin capsules, coated granules as a suspension and in combination with bicarbonate to

temporarily neutralize luminal gastric acid. For immediate acid suppression, there are intravenous formulations for lansoprazole, pantoprazole, and esomeprazole.

PPIs may lower magnesium to a level not easily replenished by supplementation and only corrected with removal of PPI. Hypomagnesemia is a serious complication that predisposes the client to tetany, seizure, muscle weakness, delirium, and cardiac arrhythmias [13]. It is not yet entirely clear what causes this adverse effect, but one hypothesis suggests that it may be due to decreased active intestinal absorption of magnesium by the transient receptor protein channels (TRPM 6/7) that are stimulated by extracellular protons [14].

The acidic environment of the stomach serves as an environment in which proteins become activated to perform certain functions as well as a chemical barrier against bacterial infection. PPIs have correlations with an increased amount of *Clostridium difficile* infections, other enteric foodborne infections and potentially increased risk of community-acquired pneumonia. An hypothesis proposed that the decreased acidic environment of the stomach leads to bacterial overgrowth and increased risk of bacterial aspiration [14]. PPIs increase the levels of gastrin, which in turn leads to increased proliferation of enterochromaffin-like (ECL) cells. ECL cells produce histamine, which under normal circumstances, stimulates parietal cells to activate their H+/K+ ATPase and produce acid into the stomach. Because PPIs act a step further than histamine, this side-effect does not negate the effect of PPIs. However, the problem lies in the discontinuation of PPIs after prolonged use, which has been shown in some cases to result in acid levels higher than before the initiation of PPIs. This effect has been referred to as rebound acid secretion [15].

Due to the frequency of PPI administration, numerous other potential associations have been reported and have received significant attention. Conflicting data have linked PPI use with osteoporosis and bone fracture; proposed mechanisms include calcium malabsorption, increased gastrin, decreased vitamin B12, and potential proton pumps in the bone. Likewise, isolated retrospective analyses have suggested a potential link between PPI use and dementia, kidney disease, and heart disease. Moreover, for dementia and heart disease, in particular, the findings, even in retrospective analyses, have been inconsistent. Following the initial development of PPIs, there was a concern for potential malignancy given prolonged gastrin elevation; however, while this was present in animal models, it has not been demonstrated in human clients [16].

PPI contraindications include clients with known hypersensitivity to that class of drugs, and their use requires caution in clients with severe hepatic disease. As mentioned above, PPIs undergo metabolism by the cytochrome P450 system of the liver, mostly by CYP2C19; hence, any severe dysfunction in this metabolization serves as a relative contraindication. That said, clinically, clinicians often use PPIs in clients with severe liver disease with increased monitoring. PPIs can also alter the activity of specific cytochrome enzymes and delay the clearance of certain drugs such as phenytoin, warfarin, and diazepam. As such, the use of these drugs requires caution in those undergoing PPI therapy. Furthermore, the stomach's acidic environment is necessary for the effective absorption of ketoconazole, and it is advisable to use other antifungals in the setting of long-term PPI use. Conversely, the same acidic environment potentiates the absorption of digoxin, and thus this drug's use merits extreme caution due to the severity of its side-effect profile [17].

There is evidence supporting the monitoring of magnesium (especially in kidney transplant clients). Monitoring of vitamin B12 levels in clients on long-term PPIs is more controversial but reasonable to consider in select cases. Currently, there is limited evidence to support bone density scanning and/or calcium supplementation as an effective means of reducing osteoporosis.

Cimetidine

H2 receptor antagonists (H2RAs) are a class of gastric acid-suppressing agents frequently used in various gastric conditions. They are FDA-approved for short-term use in treating uncomplicated gastroesophageal reflux disease (GERD**),** gastric or duodenal ulcers, gastric hypersecretion, and mild to infrequent heartburn or indigestion. These drugs are also sometimes included in a multidrug regimen for *Helicobacter pylori* eradication [18]. H2RAs may also be used off-label for stress ulcer prophylaxis, esophagitis, gastritis, gastrointestinal hemorrhage, or urticaria. H2RAs are also sometimes included in a multidrug regimen for Helicobacter pylori. Although antacids are generally considered first-line agents for heartburn during pregnancy, H2RAs are pregnancy category B with no known teratogenic effects and may be used if needed. The overall therapeutic effectiveness of H2RAs greatly depends on the severity of gastric disease, dosage regimen, and duration of therapy. This activity describes the indications, contraindications, and use of H2 blockers and highlights the inter-professional team's role in promoting their safety.

Although antacids are generally considered first-line agents for heartburn during pregnancy, H2 receptor antagonists are pregnancy category B with no known teratogenic effects and may be used if needed. H2RAs have also been shown to be safe for use in children or

adolescents with mild or infrequent heartburn symptoms that do not respond to lifestyle changes. The overall therapeutic effectiveness of H2RAs greatly depends on the severity of the gastric disease, dosage regimen, and duration of therapy.

H2RAs decrease gastric acid secretion by reversibly binding to histamine H2 receptors located on gastric parietal cells, thereby inhibiting the binding and activity of the endogenous ligand histamine. H2 blockers thus function as competitive antagonists. Normally, after a meal, gastrin stimulates histamine release from enterochromaffin-like cells, which then binds to histamine H2 receptors on gastric parietal cells and leads to gastric acid release. This increase in gastric acid release occurs through the activation of adenylate cyclase, which raises intracellular cAMP levels. cAMP then activates protein kinase A (PKA), which, among other functions, phosphorylates proteins involved in the movement of H+/K+ ATPase transporters to the plasma membrane. The increase of H+/K+ ATPase transporters at the plasma membrane allows for the secretion of more acid from parietal cells [19].

By blocking the histamine receptor and thus histamine stimulation of parietal cell acid secretion, H2RAs suppress both stimulated and basal gastric acid secretion induced by histamine. The onset of gastric relief provided by H2RAs is approximately 60 minutes with a duration of action that ranges from 4 to 10 hours, making them useful for the on-demand treatment of occasional symptoms. All H2RAs have similar efficacy in decreasing gastric acid secretion [20].

H2 receptor antagonists are well-absorbed after oral administration, and are available as a tablet for oral use. Famotidine, one of the most commonly used agents, is available as a chewable tablet, oral powder for suspension, or in combination formulations containing calcium carbonate and magnesium hydroxide or ibuprofen. Of the H2RAs, famotidine is available as an intravenous solution for use in hospital settings [20].

H2 receptor antagonists may be used as needed for gastric symptom relief or prophylactically 30 to 60 minutes before known food or beverage triggers. H2RAs may also be taken concomitantly with antacids if both quick relief of symptoms and a longer duration of action are desired. For best results, clients should take once-daily doses of H2RAs at bedtime. The more common twice-daily doses can be taken once in the morning and once in the evening. Clients should not initially self-treat with H2RAs for longer than two weeks without consulting their primary care physician.

H2 receptor antagonists are generally well-tolerated. Mild side effects may include headache, drowsiness, fatigue, abdominal pain, constipation, or diarrhea. The use of H2RAs in clients with renal impairment, hepatic impairment, or who are over 50 years of age has correlated with central nervous system side effects such as delirium, confusion, hallucinations, or slurred speech. Cimetidine is generally considered the most frequent cause of these symptoms, although similar effects have also occurred with famotidine [21].

Drug interactions with H2 receptor antagonists may occur as a result of the therapeutic increase in gastric pH because the absorption of drugs requiring an acidic environment for dissolution may become altered. Cimetidine is a potent cytochrome P450 (CYP450) enzyme inhibitor and should be avoided with other medications metabolized by CYP450 enzymes such as theophylline, selective serotonin reuptake inhibitors, or warfarin. Prolonged and high doses of cimetidine have also been linked to gynecomastia, reduced sperm count, and impotence in men and galactorrhea in women. This condition typically resolves with drug discontinuation. Many clinicians generally avoid cimetidine as a therapeutic recommendation for gastric symptoms.

Using H2 receptor antagonists on a scheduled basis may result in tachyphylaxis or tolerance, limiting their use as maintenance therapy for GERD symptoms. Tolerance to the effects of H2RAs can occur within 7 to 14 days of continued treatment. Intermittent, or as needed, H2RAs may help prevent the development of tachyphylaxis. Compared to proton pump inhibitors, H2RAs pose a minor risk for developing bacterial overgrowth and infections [23].

There are currently no absolute contraindications to H2RAs. Clients using H2RAs should be monitored for endoscopic improvement and decreased gastric symptoms to assess the clinical effectiveness and need for therapy adjustments. Clients should also be monitored for adverse effects and possible drug interactions, especially when taking cimetidine [23]

H2RAs are eliminated by a combination of hepatic and renal metabolism. Famotidine and nizatidine require dose adjustment for clients with a creatine clearance of less than 50 mL/min, while cimetidine doses should be reduced for clients with a creatine clearance of less than 30 mL/min. The half-life of cimetidine may become prolonged in clients with hepatic impairment, but for all H2RAs, no dose adjustments are required for hepatic impairment unless also accompanied by renal impairment.

Rarely, QT-prolongation or central nervous system effects have been observed in clients with impaired renal function whose dose was not properly adjusted. Famotidine use requires caution during renal impairment and in combination with other QT-prolonging medications or conditions. Elderly clients should also be monitored for central nervous system side effects such as dizziness or confusion that may

result from decreased drug clearance.

H2 receptor antagonists have a broad therapeutic index and, therefore, severe toxicity is rare. Toxicities of H2RAs may be associated with inhibition of H2 receptors in the myocardium and central nervous system. Central nervous system depression, hypotension, and bradycardia have rarely been reported and usually involve the rapid intravenous infusion of an H2RA. Treatment for toxicities related to H2RA use may include decontamination with gastric lavage or activated charcoal, discontinuation of the drug, and supportive care measures.

Many healthcare professionals prescribe H2 blockers, and there are also agents in the class available over the counter. While these drugs are relatively safe, they may produce severe adverse effects when combined with other CNS drugs. Client education by the pharmacist, nurse, and clinician, working as an interprofessional healthcare team, is key to preventing toxicity and driving improved client outcomes when using H2 receptor blocking therapy [24].

Pharmacist's Subsequent Assessment

He recommended medications has caused an improvement in the physical appearance of the client showed a better treatment outcome

Comments/Laboratory Outcome

After three days, JC showed improvement in symptoms, and haemoglobin levels stabilized. Adverse effects were monitored closely

Clients Self-Evaluation Report

Client reported a better perception of gastrointestinal wellness

Non-Pharmacological Advice:

Lifestyle counseling

JC was advised to avoid indiscriminate NSAIDs use, manage stress, and adhere to a gastro-friendly diet.

Monitoring Parameters for Progress

Periodic blood parameters indicating levels of blood such as Hb and PCV was advised.

Seeking medical Advice/Attention

The client had stabilized and may not require referral for higher care service

CONCLUSION:

This case highlights the importance of tailoring pharmaceutical care for NSAIDs-induced ulcer clients, focusing on pain management, ulcer healing, and prevention of complications.

ETHICAL CONSIDERATION

Data Availability

The data that supported the findings in this study are available on request from the corresponding author

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest.

Compliance with Ethical Guidelines

Approval for this study and related cases was obtained from the University of Uyo Health Research Ethics Committee

Author's Contribution

The authors confirm contributions as follows: study conception and design by BUM; data collection by IAI and BUM; Analysis and interpretation of results by ASP; Draft manuscript preparation by ASO; all authors reviewed the result and approved the final version of the manuscript.

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A pharmaceutical case report on hypersensitivity reaction following insect sting

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ABSTRACT

Hypersensitivity reactions from insect sting can be a severe sometimes life-threatening episode. A case of allergic reaction in a 7-year-old child following a bee sting is reported. Pharmaceutical interventions and emergency care approach with follow-up included administering epinephrine before further evaluation and management was implemented with post-medication observation. A 2h post-attention assessment revealed a positive outcome while a next day appointment visit revealed a stable child. Pharmaceutical comprehensive allergy assessment, prompt attention resolved allergic episodes an indication of a positive outcome.

KEYWORDS: Allergic reaction, Insect sting, Epinephrine, Allergy, Pharmaceutical intervention

INTRODUCTION

Most allergic reactions happen after contact with an allergen. Many reactions are mild while others can be life threatening [1]. In children, insect stings are a common trigger for allergic reactions. Prompt recognition and treatment are crucial to prevent morbidity and mortality [2]. We present a case of allergic reaction in a child following an insect sting and detailing of the clinical presentation, management, and follow-up care are scarce in the literature. Allergic reaction represents a severe allergic response marked by systemic manifestations affecting the respiratory, cardiovascular, cutaneous, and gastrointestinal systems [3]. Among children, insect stings serve as frequent instigators of this life-threatening condition. Timely identification and intervention play pivotal roles in averting adverse outcomes [4]. Herein, we illustrate a case of allergic reaction precipitated by an insect sting in a pediatric client, elucidating the clinical manifestation, therapeutic approach, and subsequent monitoring strategies [5]. Through this case study, we aim to underscore the significance of rapid recognition and appropriate management in mitigating the morbidity and mortality associated with allergic reaction in children, thereby advocating for heightened vigilance and comprehensive care in such scenarios.

METHODOLOGY/OBSERVATIONS

Nature of Encounter

A 2-visit encounter and pharmaceutical case study of a 7-year old female child with hypersensitivity reaction following an insect sting is reported.

Medical History

The client, BM a previously healthy child, presented to the pharmacy with an incidence of a bee sting on the left forearm approximately 30 minutes prior to arrival. There was no previous history of allergy to insect stings or other known allergies.

Medication History

Drug intake history of the client has been unremarkable, being a healthy child having observed all the protocols of early childhood immunization protocols.

History of Present Illness

The client developed immediate symptoms of allergic reaction shortly after the bee sting, including generalized urticaria, facial swelling, difficulty in breathing and wheezing.

Current Complaint and Presentation

Upon presentation, the client was in distress, with stridor and decreased air entry bilaterally.

Other Diseases/Co-Morbidity

The client has no other significant diseases or co-morbidities.

Familial and HEAD-SU

There is no family history of allergies or allergic reaction. The client's maternal uncle has asthma, while the paternal side has a history of hypertension and diabetes. No known history of epilepsy, sickle cell anaemia, or other significant diseases.

Surgical History

The child has not undergone any surgical procedures

Allergies

The client has no known allergy to drug, food or insect stings

Client's Current Medications

Synthetics

The client is not currently taking any medications and has just reported to the pharmacy for this episode

Natural products

The client is not currently taking any natural medications.

Client's Nutritional Intake

Special intake

No special meal type adopted

Regular intake

The client's nutritional intake includes a balanced diet consisting of fruits, vegetables and whole grains. They consume a variety of foods rich in vitamins and minerals to support overall health and well-being.

Occasional intake

The client takes yoghurt and other diary products only occasionally, due to perceived resultant stomach discomfort .

Client's Lifestyle

Professional

The client is a student.

Social

The client leads an active lifestyle, as a pupil, she engages in regular physical exercise, such as walking and cycling.

Religious

She practices the Christian fate along with her parent's disposition.

Social and Family History

The client resides in a supportive family environment with no history of allergies or significant medical

conditions among family members. Socially, the child interacts well with peers and participates in age-appropriate activities.

Physical Examination

Vital signs

The following are the details of client's vitals: Blood pressure 80/50 **(90-110/70-80);** Respiration rate 97 cycles/min **(55-90);** Pulse 140 beats per min **(50-90);** Temperature 37.4ºC **(36.1-37.2),** Body weight 36 Kg **(20-42).**

General Examination

The client appeared anxious and dyspneic, with diffuse urticaria and facial swelling. The client's condition showed marked deteriorated, requiring immediate care and intervention.

Cardiovascular Examination

An evident tachycardia with low blood pressure was observed in the client

Respiratory Examination

Widespread wheezing and decreased air entry due to chest tightness

Gastrointestinal Examination

Rapid movement of the abdominal muscles observed

Laboratory Investigations: (Pharmacist-ordered)

Imaging tests

None was recommended or performed

Biochemical tests

Serum tryptase levels 20 ng/ml **(**25**)**, Complete blood count (WBC; RBC; Hb; Differential), WBC 10,000cells/µl **(4,800-10,800**), RBC 3.5million cells/µl **(4.0–5.5),** Hb 12g/dl **(12-16),** (Neutrophils 53% **(40-60%),** Eosinophils 1.5% **(1-4%),** Basophils 1% **(0.5-1%),** Lymphocyte 38% **(20-40%),** Monocytes 6.5% **(2-8%)** and serum electrolytes: Sodium 101mmol/L **(136-144);** Potassium 4.9 mmol/L **(3.7-5.1);** Calcium 9.8 mg/dL **(8.5-10.2);** Chloride 86 mmol/L **(97-105);** Magnesium 1.9mg/dL **(1.7-2.2);** Phosphorus 3.4 mg/dL **(2.5-4.8);** Bicarbonate 27mmol/L **(22-30).**

Microbiological tests

None was recommended or performed

Pharmaceutical Audits:

Drug - Disease Audit

Client is currently not on any drug

Drug- Drug Audit

There is no previously administered drug to review for the client

Drug-Food Audit

There is no previously administered drug to review for possible drug –food interactions for this client.

Drug-Laboratory Test Outcome Audit

There is no previously administered drug to review for possible drug –laboratory test outcomes for this client

Drug-Lifestyle Audit

No audits performed as there was no previous drug list or prescription.

Decision to Dispense/Refill or otherwise of drugs a. Dispense/Refill- reasons and b. Hold back-reasons

Not applicable

Pharmaceutical Intervention (Reasons for Interventions/Suggestion for resolution

Not applicable

Pharmaceutical Care Goals

To resolve the medication-related problem

Pharmaceutical Care Plans

Identify the problem or risk involving medication or disease state. List medication related problems in order of priority. Specify the therapeutic goals for each medication-related problem identified. List anticipated outcomes. Monitoring requirements and further action, if necessary

Ensuing Drug Recommendation/Prescription

Epinephrine inj from 1mg/ml, a dose of 0.05mg/kg was administered and repeated after 30 min as IM route, as needed

Levocetirizine 5mg tablet once daily x 5 days

Hydrocortisone 100 mg intravenously twice daily x 5 days.

DISCUSSION

Biopharmaceutics and Pharmacology

Epinephrine

Epinephrine stimulates alpha and beta adrenergic receptors, leading to bronchodilation, vasoconstriction, and increased cardiac output. It counteracts the vasodilation and increased vascular permeability seen in allergic reaction. No significant drug interactions with epinephrine were identified. Epinephrine injection is indicated in the emergency treatment of type I allergic reactions, including anaphylaxis. It is also used to increase mean arterial blood pressure in adult clients with hypotension associated with septic shock [6-8].

Epinephrine's cardiac effects may be of use in restoring cardiac rhythm in cardiac arrest due to various causes but is not used in cardiac failure or in hemorrhagic, traumatic, or cardiogenic shock. Epinephrine is used as a hemostatic agent. It is also used in treating mucosal congestion of hay fever, rhinitis, and acute sinusitis; to relieve bronchial asthmatic paroxysms; in syncope due to complete heart block or carotid sinus hypersensitivity; for

symptomatic relief of serum sickness, urticaria, angioneurotic edema; for resuscitation in cardiac arrest following anesthetic accidents; in simple (open angle) glaucoma; for relaxation of uterine musculature and to inhibit uterine contractions. Epinephrine injection can be utilized to prolong the action of local anesthetics [9].

In addition to the above, epinephrine is used as an over the counter (OTC) agent for the intermittent symptoms of asthma, such as wheezing, tightness of chest and shortness of breath. It is also used for the maintenance of mydriasis during intraocular surgery. Epinephrine acts on alpha and beta-adrenergic receptors. Epinephrine acts on alpha and beta receptors and is the strongest alpha receptor activator [10]. Through its action on alpha-adrenergic receptors, epinephrine minimizes the vasodilation and increased the vascular permeability that occurs during anaphylaxis, which can cause the loss of intravascular fluid volume as well as hypotension. Epinephrine relaxes the smooth muscle of the bronchi and iris and is a histamine antagonist, rendering it useful in treating the manifestations of allergic reactions and associated conditions. This drug also produces an increase in blood sugar and increases glycogenolysis in the liver. Through its action on beta-adrenergic receptors, epinephrine leads to bronchial smooth muscle relaxation that helps to relieve bronchospasm, wheezing, and dyspnea that may occur during anaphylaxis [11]

Following I.V. (intravenous) injection, epinephrine disappears rapidly from the blood stream. Subcutaneously or I.M. (intramuscular) administered epinephrine has a rapid onset and short duration of action. Subcutaneous (SC) administration during asthmatic attacks may produce bronchodilation within 5 to 10 minutes, and maximal effects may occur within 20 minutes. The drug becomes fixed in the tissues rapidly

Epinephrine is rapidly inactivated mainly by enzymic transformation to metanephrine or normetanephrine, either of which is then conjugated and excreted in the urine in the form of both sulfates and glucuronides [12]. Either sequence results in the formation of 3-methoxy-4- hydroxy-mandelic acid (vanillylmandelic acid, VMA) which is shown to be detectable in the urine. Epinephrine is rapidly inactivated in the body mostly by the enzymes catechol-O-methyltransferase ((COMT)) and monoamine oxidase (MAO). The liver is abundant in the above enzymes, and is a primary, although not essential, tissue in the degradation process [13]

Levocetirizine

The drug blocks histamine receptors, particularly H1 receptors, reducing symptoms such as itching, hives, and nasal congestion. They do not interfere with the action of epinephrine but may cause drowsiness when used concomitantly [14].Levocetirizine hydrochloride (hereafter, levocetirizine) is one of the two enantiomers (R-enantiomer: levocetirizine, S-enantiomer: dextrocetirizine) of cetirizine hydrochloride (hereinafter, cetirizine). Levocetirizine is classified as a second generation antihistamine and is available for the treatment of allergic disorders, such as allergic rhinitis and chronic idiopathic urticaria [15, 16].

The antihistaminic activity of cetirizine is primarily due to levocetirizine, which has high affinity and selective antagonistic activity against histamine (H_1) receptors and inhibits eosinophil chemotaxis. A large number of clinical studies have demonstrated the efficacy, tolerability, long-term safety, and patient satisfaction of levocetirizine. Levocetirizine has been reported to be rapidly and extensively absorbed following oral administration of levocetirizine 5 mg and 10 mg as a tablet formulation in healthy Japanese male subjects, where time to reach the maximum concentration (t_{max}) was achieved between 0.8–1 h after administration and declined with the terminal half-life ($t_{1/2}$) of 7.3–7.6 h. Levocetirizine is eliminated predominantly by renal excretion, with limited metabolism [17-19].

Hydrocortisone

Suppress inflammation and immune responses by inhibiting the production of inflammatory mediators. They are used as adjunctive therapy to prevent biphasic reactions and reduce inflammation in allergic reaction. No significant drug interactions with epinephrine were identified [20, 21]

Hydrocortisone, also known as cortisol, is a short-acting glucocorticoid. After oral administration, hydrocortisone is readily absorbed with a biological half-life of approximately l.0–1.5 h before metabolism by the liver. The reduction of the 3-keto and 4,5-double bond of A ring by 5β-reductase and 3α/β-hydroxysteroid dehydrogenase, respectively, results in the formation of inactive metabolites. The excretion of hydrocortisone mainly occurs through the urine as urocortisol, cortisone, and glucuronic acid/sulfate conjugates of 5β-dihydrocortisol. Hydrocortisone is therapeutically used as a replacement therapy for acute/chronic adrenal insufficiency, status asthmaticus, and shock. In addition to its anti-inflammatory and blood pressure stabilizing effects, hydrocortisone has

been shown to decrease oxidative stress, increase the levels of extracellular superoxide dismutase (ECSOD), and decrease PDE5 activity [18, 19].

The bioavailability (*F*) of hydrocortisone is high (0.95), and the maximum cortisol concentration (C_{max}) and area under the cortisol concentration-time profile (AUC) of hydrocortisone are dose-dependent in the clinically relevant doses after both intravenous (iv) and oral administration [20]. The PK of hydrocortisone in pediatric patients with CAH has mostly been characterized with less sophisticated PK approaches [21]. The versatile population PK approach has rarely been applied to simultaneously understand the typical PK behavior of the population, the associated variability between and within patients, as well as the influence of demographic or other relevant patient factors [22].

In healthy children, the hypothalamo-pituitary adrenal (HPA) axis regulates the glucocorticoid cortisol, and indirectly the adrenal androgens, with a negative feedback inhibition loop. The circadian rhythm of cortisol is generated in turn by the central hypothalamic circadian clocks. In the absence of this negative feedback in patients with 21-hydroxylase deficiency, one of the cortisol precursors, 17-hydroxyprogesterone (17-OHP), is elevated and is commonly used as a biomarker for hydrocortisone therapeutic success. Mimicking the circadian rhythm of cortisol in CAH patients should result in physiological feedback and a beneficial treatment outcome [23].

Pharmacist's subsequent Assessment

During the first follow-up visit, the client's response to the newly initiated drugs was evaluated. Additionally, any adverse effects or unexpected outcomes were documented for further evaluation and management.

Comment/Laboratory Outcome

The laboratory results revealed a positive response to the treatment regimen, with improvement in relevant parameters such as inflammatory markers, allergic response indicators, and overall clinical status. Any notable findings or deviations from expected outcomes were carefully analyzed and addressed accordingly.

Client's Self-Evaluation Report

Client reported that the previously experienced condition had shown relief progressively

Non-Pharmacological Advice:

Lifestyle counseling

Avoiding of contact with insect by wearing protective clothing and using insect repellents will reduce futre events.

Education on recognizing early signs of allergic reaction and seeking prompt medical attention will facilitate quicker intervention

Monitoring parameters for progress

There was no need for monitoring of progress of the ailment as the condition was progressively and positively resolving.

Seeking Medical Advice/Attention

There was no need to seek further medical attention for the client as the condition abated as expected timeously

CONCLUSION:

Allergic reaction following an insect sting is a potentially life-threatening condition that requires prompt recognition and treatment. This case underscores the importance of timely intervention, appropriate use of epinephrine, and comprehensive allergy assessment to prevent future episodes and improve client outcomes.

ETHICAL CONSIDERATIONS

Data Availability

Request for further data on the case study can be obtained from the correspondence author

Conflict of Interest:

No conflict of interest is declared by the author.

Compliance with Ethical Guidelines

Approval for this study and related cases was obtained from the University of Uyo Health Research Ethics Committee

Authors' contributions

The authors confirm contributions as follows: study conception and design by EEV and AUM; data collection by AUM; Analysis and interpretation of results by SMN and ASO; Draft manuscript preparation by EEV; All authors reviewed the result and approved the final version of the manuscript

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GUIDE TO AUTHORS

A pharmaceutical case of hypertension management with adverse reactions to medications

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ABSTRACT

Hypertension is a significant public health concern due to its high prevalence and association with cardiovascular diseases and other complications. A client with a long history of hypertension presented with adverse reactions to prescribed medications, including headaches, tension, and moderate dull headache, during a hypertensive urgency event. Pharmaceutical care was tailored to address lifestyle and social factors, as well as drug interactions, to improve medication outcomes. Through optimized medication scheduling and stress management, the client achieved improved outcomes and enhanced quality of life. This case demonstrates the positive impact of pharmaceutical intervention on disease management and client well-being.

KEYWORDS: Hypertension, Antihypertensive Medications, Drug Interactions, Pharmaceutical Care, Adverse Reactions

INTRODUCTION

Hypertension is a major risk factor for cardiovascular disease, and its effective management is crucial for reducing cardiovascular morbidity and mortality [1]. Lowering blood pressure to less than 130 mmHg has been shown to prevent complications in clients with heart failure, diabetes, coronary artery disease, stroke, and other cardiovascular conditions [2]. However, adverse reactions to antihypertensive medications can pose significant challenges to management [3, 4]. Despite this, there is a paucity of literature reporting on adverse reactions to antihypertensives in pharmaceutical case studies. The primary objective of antihypertensive treatment is to reduce renal and cardiovascular morbidity and mortality [5]. To achieve this, clients must adhere to both pharmacologic and non-pharmacologic management strategies, emphasizing the importance of client education and compliance (6)."First-dose reactions are ADEs that occur with the initial dose or when the dosage is increased. First-dose reactions have been described with the use of α-receptor blockers, calcium channel blockers, ACE inhibitors, and β-blockers [7]. These reactions are frequently dose related and may result from an abrupt lowering of blood pressure, causing postural hypotension, dizziness, syncope, headaches, lethargy, or other symptoms.

This case study aims to present a detailed report of a client who experienced adverse reactions to antihypertensive medications, despite diligent adherence, and investigate the impact of lifestyle and social factors on drug efficacy and toxicity. By examining the interplay between pharmacological and non-pharmacological factors, this study seeks to provide valuable insights into optimizing hypertension management and improving client outcomes.

METHODOLOGY/OBSERVATIONS

Nature of Encounters

A multi-visit case study of a 50-year-old female client, referred to as ND, is presented.

Medical History

The client, ND, a 50-year-old female with a body mass index (BMI) of 26.4, has been managed for hypertension for 15 years. Her medical history reveals multiple hospitalizations, each lasting at least a week, for various conditions including anemia and hepatitis-related complications. Currently, she is experiencing recurrent and severe hypertensive episodes, accompanied by debilitating headaches and tension.

Medication History

ND has a significant medication history dating back to her childhood, during which she received frequent courses of antimalarial drugs. Additionally, she was consistently prescribed hematinics, suggesting a history of anemia or iron deficiency. This extensive medication history may have potential implications for her current health status and medication management.

History of Present Illness

The client reported a deliberate weight loss of 20 kg over the past year, with no experience of fever, night sweats, or gastrointestinal symptoms. However, she acknowledged experiencing a persistent cough, dyspnea, and exertional shortness of breath. Her visit to the pharmacy was prompted by a perceived destabilization of her overall metabolic health, which she described as feeling unwell and disconnected from her body.

Current Complaint or Presentation

The client presented with uncontrolled hypertension, despite compliance with her prescribed antihypertensive regimen, and reported symptoms of moderate dull headaches and tension, indicating potential treatment resistance or underlying cardiovascular complications.

Other Diseases/Co-morbidity

The client did not report any noticeable symptoms or indications of other underlying diseases or co-morbidities, suggesting a relatively isolated presentation of hypertension and related symptoms.

Familial and HEAD-SU

The client's family medical history reveals no instances of hypertension or epilepsy, but does show a history of other health conditions: a maternal uncle who passed away due to complications from asthma and diabetes, and paternal relatives who suffered from peptic ulcers. This suggests a potential genetic predisposition to certain health conditions, which may be relevant to the client's current health status and future risk factors.

Surgical History

The client has a history of surgical intervention, having undergone an appendectomy approximately 5 years ago, and also underwent dental restoration procedures last year, indicating a history of gastrointestinal and dental issues, respectively.

Allergies

He has a known allergy to sulphonamide agents. No recorded experience of disturbance with food or the environment.

Client's Current Medications: Currently taken medications

Synthetics

Amlodipine Norvasc®, 5 mg tablet once daily, Hydrochlorothiazide (HCTZ, 25 mg once daily)

Natural Products

None reported.

Client's Nutritional Intake

Special intake

Client is on a vegetarian diet

Regular intake

ND reported consuming carbonated beverages more frequently than hot drinks, indicating a preference for

fizzy drinks over warm or hot beverages like tea, coffee, or hot chocolate.

Occasional intake

ND reported consuming mayonnaise and butter as spreads on bread, indicating a preference for rich and savory condiments as part of her dietary habits.

Client's Lifestyle

Professional

The patient is employed at a cookie bakery, indicating occupational exposure to sweet treats and potentially influencing her dietary habits and health status.

Social

The patient is married and has three children, and is in a monogamous relationship. She also reported a significant history of smoking, having previously consumed 30 cigarettes per day, but successfully quit two years ago, indicating a notable achievement in overcoming nicotine addiction.

Religious

She reported that she is a nominal Christian

Social and Family History

The patient has experienced significant loss and bereavement, with the passing of her husband four years ago and both parents in a car accident less than a year ago. Following this tragic event, she has become increasingly withdrawn and isolated, avoiding social gatherings and activities that she previously enjoyed, indicating a potential struggle with grief and emotional distress.

Physical Examination:

Vital signs

Blood Pressure; 140/95**(90-120/60-80);** Respiration rate 21 breaths/min **(12-18);** Heart rate 86 **(60-100);** Body temperature 37.1^{o}C **(36.5-37.3);** BMI 28 **(20-24.9).**

General Examination

ND presented with visible signs of distress, appeared with tearful eyes and an unsteady gait, suggesting emotional turmoil and potential physical instability or imbalance.

Cardiovascular system

Cardiovascular examination revealed no abnormalities

Respiratory system

Not remarkable

Gastrointestinal system

Physical examination of the client did not reveal any significant or remarkable abnormalities in the gastrointestinal system, suggesting that her symptoms are not likely related to any obvious gastrointestinal issues.

Laboratory Investigations: (Pharmacist ordered)

Imaging tests

Chest X-ray revealed mild interstitial pneumonitis

Biochemical tests

Biochemical test results for the client are as follows: AST 90 IU/ml (0-45); ALT 112 IU/ml (0-45); Total protein test 79g/L **(60-83);** ALP 67 IU/ml **(30-120)** ; AFP 10 ng/mL(**0-10**); GGT 45IU/L **(0-50);** Pancytopenia with platelet count of 52,000 per mm3 **(150-450,000)**, RBC 4.1 x 10^{6} cells/ml **(4.7-6.1 x 10^{6})** : WBC 3.5 x 10^{3} /ml **(5.0-11.0 x 10^{3});** Haemoglobin 8.3 g/dl **(12-16);** LDL 112 mg/dL **(<100); HDL76** mg/dL **(>60);** TT 169 mg/dL **(<150);** TC187mg/dL **(<200).**

Microbiological tests

Negative blood cultures to infectious agents

Pharmaceutical Audit

Drug-Disease Audi

Drug is appropriate for the disease condition and level

Drug-Drug Audit

The patient's current medication regimen does not indicate any potential drug-drug interactions, suggesting that the medications are compatible and can be safely co-administered without significant risk of adverse interactions.

Drug-Food Audit

The patient's medication regimen does not show any significant interactions with their diet or special foods they are consuming, indicating that their medications can be safely taken with their usual food and beverages without any harmful effects.

Drug Laboratory Test-Outcome Audit

The laboratory test results suggest that the client has suffered some degree of liver damage, which is not being adequately addressed by their current medication regimen. Elevated levels of AST and ALT enzymes indicate liver dysfunction, necessitating a reevaluation and adjustment of their medication dosages to mitigate potential harm.

Decision to Dispense/Refill or otherwise of Drugs: a – Dispense/Refill- reasons or b. Hold back - reasons

The prescription will be dispensed. Reducing the effect of raised blood pressure on the renal and cardiovascular

Drug Therapy Problem Observed

This case presents several actual and potential drug therapy issues. Notably, certain essential medications have been overlooked in the prescription. Additionally, the patient has exhibited a reaction to hydrochlorothiazide, which is a concern given the reported associations

between antihypertensive drugs and adverse reactions, particularly during the initial stages of treatment.

Pharmaceutical Intervention: Reasons for intervention/Suggestion for resolution)

In light of the elevated liver enzyme levels revealed by the laboratory results, it is necessary to discontinue the use of hydrochlorothiazide. Furthermore, based on the laboratory diagnosis of Peptic Ulcer Disease (PUD), alternative medications will be recommended to manage this condition.

Pharmaceutical Care Goals

To enhance medication effectiveness and promote better health outcomes, our goal is to identify and address both actual and potential drug-related issues in our client's treatment plan, thereby resolving any potential problems and optimizing their medication regimen for improved results.

Pharmaceutical Care Plans

To supplement the original prescription with the necessary medications that were initially overlooked, and to schedule follow-up appointments with the client to monitor and evaluate the effectiveness and outcomes of the revised medication regimen.

Ensuing Drug Recommendations and Prescription

Livercap one capsule twice daily x 30 days
Cimetidine 400 mg tablet twice daily x 30 days
Lansoprazole 20 mg tablet twice daily x 30 days

DISCUSSIONS

Biopharmaceutics and Pharmacology

Amlodipine

Amlodipine is a medication that relaxes blood vessels by directly targeting vascular smooth muscle, leading to decreased peripheral vascular resistance and lower blood pressure. As a dihydropyridine calcium channel blocker, it works by inhibiting the entry of calcium ions into both vascular smooth muscle and cardiac muscle cells. By binding to specific sites on cell membranes, amlodipine selectively blocks calcium ion influx, thereby relaxing muscle cells. This effect is more pronounced in vascular smooth muscle cells than cardiac muscle cells, making amlodipine an effective vasodilator [9]. Amlodipine has a vasodilatory effect on peripheral arterioles, which decreases the total peripheral resistance, reducing the workload of the heart. This leads to a decrease in myocardial energy consumption and oxygen demand, without affecting heart rate. Additionally, amlodipine dilates main coronary arteries and arterioles, increasing myocardial oxygen supply, particularly in individuals with coronary artery spasm or variant angina. This also counteracts coronary vasoconstriction caused by smoking, further contributing to its blood pressure-lowering effects [10].

Amlodipine is absorbed slowly but extensively from the gastrointestinal tract, reaching peak plasma concentrations between 6-12 hours after oral administration. Its bioavailability ranges from 64-90%. Steady-state levels are achieved within 7-8 days of continuous daily dosing. Food does not affect its absorption. Amlodipine has a large volume of distribution (21 L/kg) and is highly protein-bound (approximately 98%). It undergoes extensive hepatic metabolism, with nearly 90% converted to inactive metabolites, and is primarily excreted in the urine (60% as metabolites, 10% as unchanged drug). In hypertensive patients, approximately 93% of circulating amlodipine is bound to plasma proteins, as shown in ex vivo studies [11].

Amlodipine is eliminated from the plasma in a two-phase process, with a terminal half-life of 30-50 hours. Steady-state plasma levels are achieved within 7-8 days of continuous daily dosing. Only 10% of amlodipine is excreted unchanged in the urine, while the remainder is metabolized. Notably, amlodipine can be administered at standard doses in patients with renal failure, without the need for dose adjustment [11].

In patients with impaired hepatic function, the plasma elimination half-life of amlodipine is prolonged to 56 hours, requiring cautious titration in severe cases. In healthy individuals, total body clearance is approximately 7 ml/min/kg, but elderly patients exhibit reduced clearance, leading to a 40-60% increase in AUC, suggesting a lower initial dose may be necessary [12]. Overdose can result in profound peripheral vasodilation, potentially causing reflex tachycardia, severe hypotension, shock, and even fatal outcomes. Amlodipine's pharmacologic profile is

characterized by near-complete absorption, delayed peak plasma concentrations, high bioavailability, and slow hepatic metabolism, resulting in extensive conversion to inactive metabolites, with primarily renal excretion [12].

Hydrochlorothiazide

Hydrochlorothiazide and similar thiazide diuretics are considered a first-line, cost-effective treatment option for uncomplicated hypertension. Initially developed to enhance carbonic anhydrase inhibitors, they were found to have a distinct mechanism of action. Unlike carbonic anhydrase inhibitors, which primarily increase sodium bicarbonate excretion, thiazides were discovered to predominantly increase sodium chloride excretion, an effect that occurs independently of carbonic anhydrase inhibition, making them a valuable class of antihypertensive drugs [13].

The use of thiazide diuretics raises concerns about hypokalemia, impaired glucose tolerance, and increased serum cholesterol and uric acid levels [14]. Like loop diuretics, the most severe adverse events are related to fluid and electrolyte imbalances. Common side effects include vertigo, headache, paresthesias, vision changes, weakness, anorexia, nausea, vomiting, cramping, diarrhea, constipation, and skin rashes. The exact mechanism behind impaired glucose tolerance is unclear but may involve reduced insulin secretion and altered glucose metabolism, potentially unmasking latent diabetes. Thiazide diuretics may also increase LDL cholesterol, total cholesterol, and triglyceride levels. Rarely, hydrochlorothiazide therapy can cause hepatotoxicity, a serious but uncommon adverse event that has only been reported in a few clinical cases [14].

The exact mechanism by which thiazides lower blood pressure remains unclear. However, hydrochlorothiazide is known to act on the distal renal tubules, influencing electrolyte reabsorption. It increases sodium and chloride excretion in roughly equal amounts, leading to natriuresis, which may be accompanied by minor losses of potassium and bicarbonate. Following oral administration, diuresis begins within 2 hours, reaches its peak in approximately 4 hours, and persists for 6-12 hours. Hydrochlorothiazide is not metabolized and is rapidly eliminated by the kidneys, with a plasma half-life ranging from 5.6 to 14.8 hours. At least 61% of the oral dose is excreted unchanged within 24 hours. Additionally, hydrochlorothiazide crosses the placental barrier and is excreted in breast milk, but does not penetrate the blood-brain barrier [15].

Hydrochlorothiazide directly blocks the sodium chloride co-transporter in the distal convoluted tubules of the kidney, leading to natriuresis and diuresis. In contrast, aldosterone, a mineralocorticoid hormone, regulates sodium reabsorption and potassium excretion in the collecting ducts. When sodium levels rise in the collecting duct, aldosterone binds to its receptor, triggering the expression of ion transport channels. This results in sodium reabsorption through epithelial sodium channels in principal cells and potassium excretion in intercalated cells. However, hydrochlorothiazide therapy counteracts this aldosterone-mediated effect, promoting sodium excretion and diuresis, ultimately leading to a decrease in blood pressure [16].

Pharmacist's Subsequent Assessment

The investigation revealed that certain lifestyle and social factors were contributing to the adverse reactions observed. To address these issues and ensure the client's safety and optimal hypertension management, a comprehensive pharmaceutical care plan was developed and proposed as a follow-up care plan, targeting drug therapy problems and promoting overall well-being.

Comment/Laboratory Outcome

Subsequent test on the triglyceride levels132mg/dl and the previously elevated transaminase levels AST 29IU/L and ALT 31 IU/L have shown reduced values.

Client's Self Evaluation Report

The client reported a significant improvement in her overall health, which was supported by notable enhancements in clinical outcomes, quality of life (humanistic outcomes), and cost-effectiveness (economic outcomes), as demonstrated in this case study.

Non-Pharmacological Advice

Lifestyle counseling

To manage gastrointestinal ulcers, it's essential to avoid harmful substances like aspirin, alcohol,

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Lifestyle counseling

To manage gastrointestinal ulcers, it's essential to avoid harmful substances like aspirin, alcohol,

tobacco, and caffeine. Additionally, eating smaller, more frequent meals and reducing consumption of milk and dairy products can help minimize acid production. By focusing on nutrition, fitness, behavioral changes, and support, lifestyle therapy empowers individuals to make informed choices that prevent, manage, and improve chronic conditions like gastrointestinal ulcers, leveraging clinical expertise to promote overall well-being.

Monitoring of parameters for progress

After completing treatment, microbiological tests or a urea breath test can be used to detect the presence of Helicobacter pylori, serving as an indicator of treatment outcome and confirming whether the infection has been successfully eradicated.

Seeking medical Advice/Attention

The client's condition did not require a referral for additional medical treatment, and their care was effectively managed without the need for further intervention.

CONCLUSION:

This case highlights the crucial role of lifestyle and social factors in managing hypertension, demonstrating that personalized pharmaceutical care interventions can significantly enhance patient outcomes and safety, underscoring the importance of a comprehensive approach to hypertension management.

ETHICAL CONSIDERATIONS

Data Availability

For additional information or data related to this study, please contact the corresponding author."**Conflict of Interest:**

None declared.

Compliance with Ethical Guidelines

This study and related cases received ethical approval from the University of Uyo Health Research Ethics Committee, ensuring that the research was conducted in accordance with ethical standards and principles.

Authors' Contributions

The authors confirm contributions as follows: study conception and design EEE and MAO; data collection ASM; Analysis and interpretation of results ASO; Draft manuscript preparation AS and EEE; All authors reviewed the result and approved the final version of the manuscript.

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GUIDE TO AUTHORS

A pharmaceutical case of anaemia secondary to peptic ulcer disease in pregnancy

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ABSTRACT

Peptic ulcer disease (PUD) is a commonly encountered condition in primary care settings. A pregnant client (G4P3), presenting with anemia and a history of recurrent peptic ulcer disease (PUD), was assessed. Initial evaluation revealed pancytopenia, suggesting anemia secondary to PUD. Pharmaceutical care involved a comprehensive drug audit, considering potential drug-disease, drug-drug, drug-food, and drug-lifestyle interactions. The client was prescribed haematinics-astymin® and artemisinin-combination therapy (ACT) antimalarial (artemether-lumefantrine 80/480) in a spaced-out regimen. The client's response to intervention and overall drug audit resulted in improved economic and humanistic

KEYWORDS: Peptic ulcer disease, pregnancy, anaemia, pharmaceutical care, Pancytopenia

INTRODUCTION

Anemia is a significant global public health concern, frequently linked to Helicobacter pylori (H. pylori) infection [1]. In developing countries, anemia is a prevalent nutritional deficiency disorder affecting pregnant women, often resulting in poor pregnancy outcomes and potentially life-threatening complications for both mother and fetus [2, 3]. Notably, there is a scarcity of documented cases in the literature that highlight the importance of personalized pharmaceutical care in managing anemia during pregnancy, underscoring the need for increased awareness and evidence-based practice in this critical area.

Identifying the contributing factors of anemia in various settings is crucial for effectively addressing its burden and managing anemic patients. Numerous studies have investigated the factors associated with anemia in adults [3]. Notably, recent research has implicated Helicobacter pylori (H. pylori) infection in several hematological manifestations, including anemia, iron deficiency, and vitamin B12 deficiency [4, 5].

Recognizing the underlying factors of anemia is crucial for developing targeted interventions and providing optimal care for individuals with anemia. During pregnancy, iron deficiency and folic acid deficiency are the most common causes of anemia [6]. Anemia increases the risk of pre-term delivery and post-partum maternal infections. According to guidelines, prophylactic treatment should be considered for women with a hemoglobin level of less than 11.5 g/dL at the onset of pregnancy [7]. This case study aims to report the outcome of pharmaceutical care in a pregnant woman with a history of peptic ulcer disease and anemia, highlighting the importance of personalized care in managing complex cases.

METHODOLOGY/OBSERVATIONS

Nature of Encounter

A case study of a 39-year-old pregnant woman, MF (G4P3), was conducted through a multi-visit follow-up approach.

Medical History

The client, MF, has a history of recurrent peptic ulcer disease (PUD) diagnosed 13 years prior, characterized by recurring episodes of gastrointestinal disturbances, including dyspepsia, nausea, and vomiting.

Medication History

The client, MF, has a history of a fracture over 20 years ago and was prescribed ibuprofen and diclofenac, which she has been taking intermittently, often combining the medications and obtaining them from drug vendors without a prescription. This long-term use of nonsteroidal anti-inflammatory drugs (NSAIDs) has been her attempt to manage chronic ankle pain resulting from the fracture.

History of Present Illness

The client, MF, has experienced a range of symptoms over the past year, including weight loss, chronic cough, and shortness of breath, which has worsened with exertion. These symptoms have persisted into her current pregnancy. Although the pregnancy has been largely uneventful, she has required two hospitalizations, each lasting 5 days, suggesting underlying health concerns that require close monitoring and management.

Current Complaint or Presentation

MF reported that she has had leg swelling for 2 months and difficulty in breathing in the past 1 week prior to the pharmacy visit.

Other Diseases/Co-morbidity

Symptoms of other diseases include those akin to malaria (fever, pyrexia, anorexia etc).

Familial and HEAD-SU

The client has no familial history of hypertension and epilepsy. The maternal uncle died of complications of asthma and diabetes, while paternal relatives suffered from ulcer. No sickle cell haemoglobinopathy traces in her lineage.

Surgical History

Cholecystectomy 6 years and caesarean section 4 and 2 years previously were performed.

Allergies

No known allergies involving medicine, food or environment.

Client's Current Medications

Synthetics

Routine drugs (folic acid tablet 5 mg once daily; vitamin B complex tablet 2 tablets 2 times daily, ferrous sulphate tablet 100mg one tablet 2 times daily; multivite tablets one tablet 2 times daily.

Natural medications

None

Client's Nutritional intake

Special intake

Client was placed on a meal plan that is low in unhealthy fats, salt and added sugar such as lean meats, poultry (chicken and turkey), fish, beans, egg and snuts alongside whole-wheat breads, cereals, pasta and brown rice.

Regular intake

Balanced diet with fruits such as cucumber, water melon and garden eggs

Occasional intake

Fast foods such as hot chips, hamburgers and pizza are taken by the client. Furthermore, MF loves sweetened condensed milk and alcoholic drinks.

Client's Lifestyle

Professional

MF is of the paramilitary setting and she lives a regimented lifestyle

Social

She belongs to 3 socio-cultural groups that meet from time to time in the city. The client is a postgraduate student, a member of the Executives in Rotary Club

Religious

Client practices Christianity with no denominational preference

Social and Family History

The client is a non-smoker presently, quitted smoking six months ago, denies alcohol and illicit drug use. She is married with three children and works in a cookie bakery.

Physical Examination

Vital Signs

The client's vitals are as follows: Temperature 36.5^{o}C **(36.1-36.8)**; Heart rate 88/min **(60-100)**; Respiratory rate 22 cc/min (12-20); Blood Pressure 130/80 mmHg **(110-130/70-90).**

General Examination

Well-appearing but anxious, conversing freely though with a little bit of respiratory distress.

Cardiovascular Examination

Regular rhythm with no murmurs, rubs, or gallops.

Respiratory Examination

Chest X-ray

Client's presented film shows mild interstitial pneumonitis.

Laboratory Investigations (Pharmacist ordered)

Imaging tests

None was ordered/performed for the client

Biochemical tests

Pancytopenia with platelet count of 74,000 platelets/mm^3 **(150,000-450,000);** Haemoglobin 8.1g/dl **(12-16 female;14-18 male);** Fasting Blood Sugar 5.3 mmol/L **(5.6);** Aspartate transaminase (AST) 86 **(<40);** Alanine transaminase (ALT) 102 U/L **(7-56);** ALP; GGT; Total Protein Test; Faecal Occult Blood (FOB) test - Positive; Urea Breath test (UBT)-Positive; Malaria Parasite (MP) Rapid-Diagnostic Test (RDT) - **(++)** and negative blood cultures for microbial presence.

Microbiological tests

None was ordered/performed for the client

Pharmaceutical Audits

Drug-Disease Audit

The current treatment plan lacks medication specifically targeting the client's peptic ulcer disease (PUD). Ferrous sulfate, a commonly used iron supplement, poses a risk of gastric irritation and mucosal damage in PUD patients, potentially leading to hemochromatosis and cirrhosis [8]. Iron therapy, in general, requires cautious administration in patients with PUD, enteritis, or ulcerative colitis due to the risk of gastrointestinal irritation and damage [9]. Despite this, iron supplementation is essential for the client's low hemoglobin level and pregnancy status. Therefore, an appropriate iron formulation with minimal gastrointestinal toxicity should be selected to balance the need for blood production against the risk of gastrointestinal complications.

Drug-Drug Audit

There appears to be no drug-drug interactions in the drug line up for the client.

Drug-Food Audit

The client does not take any special/regular meal requiring drug or drug dosage adjustment considerations.

Drug Laboratory Test Outcome Audit

The client's medication list appears to be inconsistent with the laboratory test results, notably omitting drugs that could alleviate elevated AST and ALT levels. The significantly elevated liver enzyme levels suggest that medications primarily metabolized by the liver should be considered for dose adjustment or alternative therapies to prevent further hepatic toxicity [10].

Drug-Lifestyle Audit

The client engages in regular physical activity and does not engage in lifestyle practices that could impact drug disposition and action, such as smoking or excessive alcohol consumption [11]. This suggests that their drug metabolism and response may not be influenced by these factors, allowing for more predictable pharmacokinetics and pharmacodynamics.

Decision to Dispense/Refill or otherwise of Drugs a. Dispense/Refill – reasons / Hold back- reasons)- if the pharmacist is not the original prescriber.

The drugs will be dispensed as there are no issues emanating from the drugs filed in the present prescription.

Drug Therapy Problems Observed

Absence of some required drugs in the present prescription to cater for the major laboratory findings

Pharmaceutical Intervention

To conduct a comprehensive drug audit, considering drug-disease, drug-drug, drug-food, and drug-lifestyle interactions highlighted

There is need to incorporate drugs for PUD for the client such as can be safe in pregnancy

Pharmaceutical Care Goals

To resolve actual and potential drug – related adverse problems in client

Pharmaceutical Care Plan

A comprehensive pharmacotherapy regimen for the client may include medications such as H2 receptor antagonists (H2RAs), which are considered safe during pregnancy and are the primary treatment option for peptic ulcer disease (PUD). However, treatment for Helicobacter pylori may be postponed until after pregnancy and breastfeeding are complete. Additionally, proton pump inhibitors like lansoprazole, which have been deemed safe for use during pregnancy, may be considered as part of the

treatment plan.

Ensuing Drug Recommendation/Prescription

Synthetic

Haematinic Astyfer® 20 ml to be taken twice daily for 14 days; Antimalarial Artemether-lumefantrine double strength (80/480), one tablet to be taken twice daily for 3 days; Iron Supplement-ferrous bisglycinate, one tablet to be taken three times daily for 10 days; Vitamin C tablets 200mg to be taken three times daily for 10 days.

Natural Product

Herbal blood builder:-Mojeega 100 ml to be taken once daily for 14 days

DISCUSSION

Biopharmaceutics and Pharmacology

Haematinic (Astyfer®)

Astyfer® is a specially formulated iron supplement that combines iron with amino acids and vitamin B complex. This unique formulation allows for optimal iron absorption while minimizing gastrointestinal irritation. By providing a balanced mix of essential nutrients, Astyfer® supports healthy red blood cell production, energy levels, and overall well-being [12].

Antimalarial (Artemether-lumefantrine)

Artemether/lumefantrine (AL) is a fixed-dose artemisinin-combination therapy (ACT) that combines the short-acting artemether with the long-acting lumefantrine. This antimalarial regimen is indicated for the treatment of uncomplicated *Plasmodium falciparum* malaria that is resistant to chloroquine [13].

Treatment with AL may commonly cause musculoskeletal pain, fever, anorexia, and headache. However, in rare cases, it can lead to a serious side effect called QT interval prolongation [14]. Although research is limited, AL appears to be safe for use during pregnancy [14]. Additionally, dose adjustment is not necessary for patients with mild to moderate renal or hepatic impairment [14].

Artemether-lumefantrine (AL) is a highly effective and well-tolerated antimalarial therapy, demonstrating high cure rates even in areas with multi-drug resistant strains. However, it can cause anaphylaxis and commonly leads to mild to moderate side effects such as headache, dizziness, anorexia, sleep disturbances, tinnitus, tremors, palpitations, and gastrointestinal disorders. Food, particularly fatty meals, enhances the absorption of both artemether and lumefantrine, and patients should take the medication with food as soon as possible. Coartem (AL) may prolong the QT interval, increasing the risk of ventricular fibrillation when combined with other QT-prolonging drugs. Concomitant use with halofantrine is contraindicated due to the risk of life-threatening QT prolongation. Additionally, drugs and substances that inhibit or induce the liver enzyme CYP3A4, including grapefruit juice, can significantly impact blood levels of artemether and lumefantrine, leading to either increased side effects or reduced efficacy [15].

Ferrous bisglycinate

Iron(II) gluconate, also known as ferrous gluconate, is a black-colored compound utilized as an iron supplement. As the iron(II) salt of gluconic acid, it has proven effective in treating hypochromic anemia. Compared to other iron preparations, ferrous gluconate elicits satisfactory reticulocyte responses, high iron utilization, and rapid hemoglobin increase, achieving normal levels within a relatively short period [16]. However, ferrous gluconate can be toxic in cases of overdose, with children exhibiting signs of toxicity at ingestions of 10-20 mg/kg of elemental iron. Ingestions exceeding 60 mg/kg can lead to severe toxicity. Iron toxicity manifests in both local and systemic effects, including gastrointestinal corrosion, cardiovascular disturbances (dehydration, hypotension, tachycardia, shock), pulmonary, hepatic, and neurological symptoms (diarrhea, nausea, vomiting blood, chills, dizziness, coma, convulsions, headache), as well as dermatological effects (flushing, pallor, cyanosis of lips and fingernails). Symptoms may initially resolve within hours but often recur after 1 or more days [17].

Iron has no specific excretory mechanism. Therefore, iron supplementation only addresses hemoglobin abnormalities caused by iron deficiency and is not indicated in conditions such as thalassemia, hemosiderosis, hemochromatosis, normocytic anemia (unless iron deficiency coexists), or in patients receiving blood transfusions. Regular clinical monitoring of erythropoietic function and serum ferritin levels is essential to ensure appropriate treatment and prevent potential complications [18].

Vitamin C

Vitamin C plays a crucial role in enhancing iron absorption in the gastrointestinal tract, although the precise mechanism by which it alleviates anemia remains unclear. One proposed hypothesis suggests that vitamin C facilitates the mobilization of stored iron from Kupffer cells in the liver and other reticuloendothelial sites, increasing the availability of iron for erythropoiesis [19]. The pharmacokinetics of vitamin C are complex, with absorption and elimination primarily regulated by saturable Sodium Dependent Vitamin C Transporters (SVCTs). This results in a dose-dependent and compartmentalized distribution pattern, with varying organ concentrations ranging from approximately 0.2 mM in muscle and heart tissue to 10 mM in brain and adrenal gland tissue at homeostasis (19).

Ranitidine

Ranitidine, a commonly used Histamine 2 Receptor Antagonist (H2RA), exhibits a profound inhibitory

effect on basal acid secretion and a less pronounced effect on stimulated acid production [20]. Additionally, it has been shown to inhibit Helicobacter pylori (H. pylori) growth. The combination of ranitidine and bismuth potassium citrate has a synergistic effect, making them a common combination in treatment regimens for gastroduodenal ulcers and H. pylori infections [21]. The availability of ranitidine bismuth citrate, a compound preparation of both drugs, enhances patient compliance and convenience. Ranitidine's pharmacokinetics has been well-documented [21]. Following oral administration, 50% of the drug is absorbed, reaching peak serum concentrations within 2-3 hours, followed by elimination with a half-life of 2.5-3 hours. Metabolism is minimal, primarily via flavin mono-oxygenases [22]. Renal elimination accounts for approximately 70% of the systemically available dose, with the majority excreted unchanged in the urine [20-22].

Lansoprazole

Lansoprazole, a benzimidazole derivative, exhibits anti-secretory and anti-ulcer properties by inhibiting acid pump activity in parietal cells [23]. The drug undergoes activation in the acidic environment of these cells and is rapidly absorbed from a gastric acid-resistant formulation, with approximately 97% protein binding in human plasma [23]. Single-dose pharmacokinetics demonstrate linearity over the 15-60mg range, with food and dosing time influencing absorption. Lansoprazole is extensively metabolized by cytochrome P450 enzymes (CYP3A4 and CYP2C18) into sulphone and 5-hydroxylated metabolites [23]. Additional metabolites, sulphide and hydroxylated sulphone, have been identified in plasma. The mean plasma elimination half-life is 1.3-2.1 hours in healthy volunteers, with 15-23% of the dose excreted in urine as hydroxylated metabolites [23]. Multiple administration does not alter the pharmacokinetic profile, and healthy elderly volunteers show similar pharmacokinetics to young volunteers [24]. Renal failure has no impact on lansoprazole pharmacokinetics, but severe hepatic failure reduces clearance and increases AUC and t1/2 [24]. No significant interactions have been observed with warfarin, prednisone, theophylline, phenazone, diazepam, phenytoin, or oral contraceptives, suggesting minimal risk of clinically significant interactions. PUD is believed to improve during pregnancy due to decreased acid secretion.

Mojeega blood builder

Mojeega, a herbal blood builder registered with the National Agency for Food and Drug Administration and Control (NAFDAC), has gained widespread recognition for its efficacy in addressing anemia-related conditions.

Pharmacist's Subsequent Assessment (after the next visit)

The client exhibited significant improvement, displaying renewed energy and a notable smile, two weeks after the intervention.

Comment/Laboratory Outcome

Fasting blood glucose levels, measured every other day for the past week, showed a satisfactory mean value of 74mg/dL. Additionally, the hemoglobin (Hb) level was 13.6g/dL, and the malaria parasite (MP) test resulted in a negative finding.

Client's Self-Evaluation Report

The client reported enhanced vitality and a improved overall sense of well-being. This case demonstrated positive clinical, humanistic, and economic outcomes.

Non-Pharmacological Advice

Lifestyle counseling

Optimize iron intake by consuming iron-rich foods such as lean red meat, chicken, and dark leafy greens, which provide readily absorbable 'haem iron'. Limit or avoid fatty foods, acidic beverages, alcohol, and heavy meals close to bedtime. Additionally, engage in stress-reducing activities to minimize anxiety and promote overall well-being.

Monitoring Parameters for Progress

The client was strongly encouraged to attend regular antenatal care appointments at the healthcare facility where she was registered, to ensure adequate monitoring and support throughout her pregnancy.

Seeking Medical Advice/Attention

In the event of any concerns or complications, the client was instructed to contact the pharmacy or seek immediate medical attention at her designated antenatal care facility, where she can receive prompt guidance and support from qualified healthcare professionals.

CONCLUSION

The provision of comprehensive pharmaceutical care, encompassing thorough drug audit and targeted intervention, played a crucial role in achieving favorable outcomes in the management of anemia secondary to peptic ulcer disease in this pregnant patient. This multidisciplinary approach ensured optimal medication use, mitigated potential drug-related issues, and contributed to the patient's positive health trajectory.

ETHICAL CONSIDERATIONS

Data Availability

Additional information and data related to this publication are available upon request. Please contact the lead author directly to access supplementary materials, datasets, or other relevant details.

Conflict of Interest:

No conflict of interest

Compliance with Ethical Guidelines

Approval for this study and related cases was obtained

from the University of Uyo Health Research Ethics Committee

Authors' Contributions

The authors confirm contributions as follows: study conception and design CSR; data collection ASA; Analysis and interpretation of results EE and ASO; Draft manuscript preparation ASO; All authors reviewed the result and approved the final version of the manuscript

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