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The profession of pharmacy in India which was industry – centric so far is slowly becoming patient – centric in line with international scenario. Training pharmacists into patient counseling, therapeutic drug monitoring, adverse drug reaction monitoring and pharmacovigilence has become the focal point of the profession. A two year Post graduate course in Pharmacy practice and newly introduced Six year Pharm.D. Course, are centered on training in this area. These courses are designed to train the students in a clinical environment of a hospital where the skill acquisition is through ward round participation, analysis of cases, discussions, interactions with other health care professional and patient counselors.

The pharmacy practice division of NGSM institute of Pharmaceutical Sciences in association with a 1200 bed K.S. Hegde Charitable Hospital, is providing the facilities to train the student in the nuances of clinical, hospital and community pharmacy, and also practice of pharmacotherapy and pharmacovigilence.

In its endeavor to disseminate information to all health care professionals on the latest developments in the drug industries, profiles of newly approved drugs, current trends in drug treatment, and adverse events associated during their use, the department of Pharmacy Practice has brought out its 1st quarterly newsletter “PHARMACY PRACTICE COMMUNICATOR” which we wish will be of use to other healthcare providers and also act as a platform for them to make their observations. I request the Doctors, Dentists, all other Paramedical professionals and researchers to share their professional experiences, observations and new learnings in the form of short communications or articles in the newsletter. Awaiting your observations and comments.

Dr. C.S. Shastry
Editor-in-chief
PHARMACY PRACTICE COMMUNICATOR

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The Department of Pharmacy Practice was established in the year 2010 with the twin objective of providing quality healthcare services and academic training of pharmacists for Post graduate specialization in Pharmacy Practice. Currently it is also involved with the undergraduate training of students who pursue the six year Pharm.D course. The department is located in Justice K.S. Hegde Charitable Hospital at Derelakatte, Mangalore.

It has well developed infrastructure to meet academic and research needs and also provides services like Evidence Based Drug Information Service, Patient Counseling, Poison Information, Drug Interaction Information and a Pharmacovigilence center to report Adverse Drug Reactions.

A team lead by Dr. D.S. Puranik M. Pharm, Ph.D. along with Mr. Juno J. Joel and Mr. Javedh Shareef who are specialized in Pharmacy Practice are actively involved in the day to day running of the department and are actively assisted by Medical practitioners, Pharmacists and other Health care professionals of the hospital.

**ACTIVITIES OF PHARMACY PRACTICE DEPARTMENT**

**Drug Information Service**
Evidence based Information regarding availability of various dosage forms of a drug, its dosage regimen, indications for dose alterations, contraindications, side effects, reported adverse effects, treatment in case of acute poisoning, are provided to all health care professionals using various journal references and the latest version of Iowa Drug Information Software, developed by the department of Pharmacy Practice, University of Iowa. Facility is also provided for case presentations and discussions in the department.

**Patient Counselling**
Well trained pharmacists provide counselling to inpatients and outpatients to improve medication adherence and therapeutic outcome, especially in conditions like hypertension, diabetes, peptic ulcer, anemia, asthma and patients with co morbidities. Counselling aids such as pictorial information leaflets, blank drug dispensers and education of immediate care taker of patient are used to overcome language barriers and literacy limitations.

**Ward round Participation**
Students attend ward rounds along with their mentor and medical practitioners, during which they learn to review the case sheets, identify drug related problems and learn practical aspects of drug therapy from the medical staff.

**Case Presentation**
Case presentations and discussions are held on a daily basis after the ward rounds. The students are trained to observer for drug interventions and suggest suitable alternative drug regimen or dose correction wherever necessary.

**Participation in Public Health Programs**
Students and staff regularly participate in different health care programs and camps drawn up by various departments of the hospital, they are also made to participate in rural out reach programs and health surveys which are source of valuable data on, misuse of drugs, under utilization, over utilization and self medication.

**Adverse Drug Reaction Monitoring**
All suspected adverse drug reactions observed in the hospital are carefully monitored and recorded by the department for future interventions. Development of a Pharmacovigilence reporting center is in the offing.

**Hospital Pharmacy Training**
Students are trained for dispensing medicines in the Pharmacy at the hospital where they provide instructions on the usage of drugs to outpatients. They are also trained to evolve a hospital formulary.

**Community Pharmacy Services**
Department organizes regular meets with retail pharmacists in and around the hospital and also those in the near by cities and rural areas. They are provided with latest information on new drugs, observe for adverse drug reactions and report the to the center in the department for further processing.
Evolving role of SGLT2 Inhibitors in the treatment of Type 2 Diabetes Mellitus

Kripa G S*  

**Diabetes Mellitus** is one among a group of metabolic diseases characterized by chronic hyperglycaemia; disturbances of carbohydrate, fat and protein metabolism, due to deficient insulin secretion; action; or both. Uncontrolled hyperglycaemia can lead to development of many long term complications leading to changes in heart, peripheral blood vessels, and cerebrum caused by the formation of plaques in their macro-vascularule. Hyperglycaemia induced Retinopathy, neuropathy, nephropathy and foot ulcers also occur due to defective focal microvasculature in the eye, kidney and the foot. These complications adversely affect the quality of life of diabetic patients. Left untreated, these complications can lead to significant morbidity and mortality.

Agents currently used in the management of diabetes mellitus are often limited by their potential to induce significant adverse effects paving the way for noncompliance and therapeutic failure. Drugs like metformin are known to cause diarrhea, nausea, and lactic acidosis in a few cases. Sulphonylureas, insulin, thiazolidinediones can induce hyperglycaemia as well as weight gain. Newer drugs such as the incretin mimetic and dipeptidyl peptidase inhibitors may produce nausea, vomiting and diarrhoea. Search for drugs acting on novel target with different mechanism of action and free of the pitfalls associated with existing drugs used in controlling hyperglycaemia continues.

Reabsorption of glucose that is filtered through the glomerulus occurs to a level of 90% in healthy individuals in the proximal convoluted tubule (PCT) via sodium-coupled glucose transporters (SGLT), and the remaining 10% in the distal straight segment of the PCT2. However, beyond plasma concentrations > 11 mmol/litre, glucose starts to appear in the urine, as at this concentration the renal threshold for reabsorption of glucose is exceeded.

Six types of sodium-glucose co-transporters (SGLT) have been identified in the kidney and have been named from SGLT1 to SGLT6. Among them SGLT2 and SGLT1 actively transport glucose across the epithelial cells of the proximal convoluted tubule in the kidney with a variable transport capacity. SGLT2 is a high-capacity, low-affinity transporter and is thought to account for approximately 90% of glucose reabsorption in the kidney. Its expression is limited to the kidney and is therefore identified as a potential target in the search for newer drugs, in ant diabetic drug discovery programs. SGLT1 is expressed in the small intestine and the distal segment of the PCT and accounts for < 10% of glucose reabsorption in the straight part of the PTC.

**SGLT2 Inhibitors**

Phlorizin, discovered in 1835 and later isolated from the bark of apple trees, was observed to induce glycosuria in humans by inhibiting renal glucose reabsorption. The observation later led to the discovery of the existence of SGLT2 transporters in the nephron. Complete reabsorption of glucose that has filtered into the lumen of the nephron takes place as long as the concentration of the filtered blood glucose level does not exceed the maximal reabsorption rate of glucose in the nephron. Reducing the reabsorption of glucose can result in glycosuria and also reduced plasma glucose concentration level which may be of use in in diabetes. SGLT2 Inhibitors by their ability to interfere with the functioning of SGLT2, increase glycosuria in diabetics, as a consequence of which plasma glucose level is lowered. The pitfalls associated with glucose toxicity, increased plasma insulin and glycosylated haemoglobin levels are avoided. The reduced plasma glucose levels improve sensitivity of liver to insulin. Hepatic glucose production is also suppressed leading to an improvement in the diabetic state. Other advantages that will be associated with their use are:

- Net loss of calories from the body and maintenance of overall negative energy balance by causing glycosuria which is an advantage in the treatment of Type 2 Diabetes Mellitus
- Inability to induce insulin secretion or inhibit hepatic glucose production thereby avoiding hypoglycaemia.
- Indirect preservation of beta-cells by depletion of toxic glucose concentration in blood and improving insulin sensitivity.
- Increased osmotic diuresis which may be advantageous in patients with hypertension and CHF.

**Dapagliflozin** is the furthest advanced compound in clinical development belonging to the SGLT2 inhibitor class. It has shown promising results in various preclinical and clinical studies of T2DM. Administration of a single dose of dapagliflozin induced renal glucose excretion normal and diabetic rats without causing hypoglycaemia. A number of SGLT2 inhibitors are currently in phase 2/3 clinical trials, including canagliflozin, empagliflozin, ipragliflozin, luseogliflozin, tofogliflozin and ertugliflozin.

**CONCLUSION**

SGLT2 glucose transporter inhibitors appear to provide a promising new therapeutic approach in the management of T2DM with the advantages of achieving reduced pre-prandial and post prandial serum glucose levels, decreased glucose toxicity, reduced glycosylated hemoglobin and weight reduction without inducing hypoglycaemia. Currently, several clinical trials are ongoing to prove the safety and efficacy of SGLT2 Inhibitors. If the results of longer term clinical trials are satisfactory they can be expected to be the drug of the future in the treatment for Type 2 Diabetes Mellitus either as mono therapeutic agent or as an add on drug in existing therapeutic strategies.

**REFERENCES**

Botox injection: Will it be the end of road to migraine?
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Migraine is a common chronic neurovascular disorder characterized by attacks of debilitating pain that greatly affects the quality of life and social activities. It usually presents with widely varying symptoms such as headaches that are usually unilateral, throbbing and accompanied by nausea and vomiting, sensitivity to light, sound or movement. It has also been ranked by the WHO as one of the most disabling cause of the medical illness affecting 15 – 20% of women and 10-15% of men with a female to male ratio 3:1 migraine in the world. In India, 15-20% of the people suffers from migraine3. Although brain stem and hypothalamic generators have been proposed as the mechanism to cause migraine, the brain location initiating a migraine attack is still unclear. Also it is very likely but as yet not proven beyond doubt that hereditary factors play a major role in the individual susceptibility to migraine attacks. It is also expected that neurological, hormonal or circulatory levels could also play a role in the occurrence of migraine attacks4. Migraine has been classified by the Headache classification committee 2004 as Migraine without aura, Probable migraine without aura, Migraine with aura, Probable migraine with aura, Childhood periodic syndromes that are commonly precursors of migraine, Retinal migraine and Complications of migraine. Although migraine attacks are separable into those with and without aura, the two types are mutually exclusive and many patients have attacks of each type. The headache is similar in both types and typically consists of episodic unilateral throbbing head of moderate to severe intensity that if untreated persists from 4 hours to 3 days and tends to worse with routine physical exertion5. The effect of migraine on the life style of sufferers can lead to loss of function and limit the number of working days. The primary step towards the effective management of chronic migraine is identification of the precipitating factors which can contribute to the chronicity of headache including the medication overuse, co-administration of medications which can exacerbate the migraine and consideration of triggering factors such as stress, weather changes, missing meals, under and over sleeping, over use of caffeine’s, food sensitivity, perfume, cigarette smoke, exercise and sexual activity that may coexist6.

The main aim of the treatment is to lessen the frequency and severity of headache attacks and to reduce the disability with minimum medications with reviewing and modifying if necessary. Avoiding the triggering factors with advice to reduce excessive caffeine intake, stop smoking and reduce alcohol intake will also be more useful2. But the major concern in the headache treatment is deciding which migraine patient should be given preventive medicines and determines how many headaches are present. The management of migraine involves abortive medications including antiemetics and preventive medications in addition to the prophylactic that can prevent the migraine attack. The choice of abortive therapy includes first line medications such as triptans including sumatriptan, zolmitriptan, rizatriptan etc and non-triptans such as acetaminophen containing products and non-steroidal anti-inflammatory drugs. The second line abortive medications consists of dihydroergotamines, butalbital, opioids and steroids. The anti-emetics includes promethazine, prochlorperazine, metochlorpramide, domperidone and ondansetron. The overuse of abortive treatments exists in high proportion in migraine patients and the primary focus should be firstly to discontinue the overuse medication where possible or be on limiting their intake. It is also justified that medication over use can itself cause headache, as well as making the features of the underlying pain harder to characterise, and may interfere with the prophylactic treatment efficacy. Effective patient education can help to control the medication overuse up to a certain extent and it is vital to discuss the treatment plan, explain what symptoms can be expected, that an increase in headache severity may occur initially and should be transient and that a wash-out period will enable subsequent treatment to be directed at the patients true underlying headache rather than a secondary, drug induced one4.

For many patients, a simple oral analgesic such as aspirin, acetaminophen, naproxen, ibuprofen, or an analgesic combination with caffeine may be effective. Drugs class such as anti convulsants, beta blockers, tricyclic antidepressants, calcium channel blockers and natural agent petadolex are classified under as first line preventive medications for migraine. Botulinum toxin A (Botox) has been studied extensively in patients with migraine and has been approved by the FDA as a first line preventive medication for the chronic migraine. The second line migraine preventive therapy includes antiseizure medications (Gabapentin and pregabalin), muscle relaxants (cyclobenzaprine and tizanidine) and anti-depressants (desvenlafaxine, duloxetine). At this time, no evidence exists to allow accurate prediction of which of these agents will be most effective in a given patients7. The choice of the medication depends on the patient’s age, medical and psychiatric co morbidities, frequency and severity of the migraine and the patient preference8. At the same time the use of prophylaxis in the management of migraine has been recommended to decrease the frequency, severity and duration of headache in addition to improving the disability associated with the disease. It has been found that satisfactory treatment was not achieved in many patients with migraine despite the presence of a number of effective prophylactic medications.

EMPHASISING THE ROLE OF BOTULINIUM TOXIN IN THE MANAGEMENT OF MIGRAINE HEADACHE

Botulinum toxin type A (BOTOX) produced by clostridium botulinum, a gram positive anaerobic bacterium, is a purified protein that belongs to a class of compounds known as neurotoxins5. It is one of the most poisonous biological substances, approved by the FDA for various indications such as eye muscle disorders strabismus, blepharospasm, torticollis (cervical dystonia), spasmodic dysphonia, some cases of oromandibular dystonia and writer’s cramp. Recently it has also found to useful in reducing drooling of saliva in Parkinson’s disease6.

In the late 1990s and early 2000s, reports of the use of botulimum toxin type A for the treatment of headache, including migraine sounded promising based on the literatute available at the time of health plan’s
decision to cover the drug in 2003. Several open label and small controlled trials assessed the efficacy of botulinum toxin in patients with migraine, suggesting significant effectiveness in reducing migraine frequency and severity. In the preclinical models, it has been shown that botulinum toxin acts by inhibiting the release of nociceptive mediators such as glutamate, substance P and calcitonin gene–related peptide, from nociceptive fibres.

The safety and efficacy of botulinum toxin as a prophylactic treatment option for patients with chronic migraine has been assessed in one of the largest comprehensive clinical trial programme to date, known as Phase III Research Evaluating Migraine Prophylaxis Therapy (PREEMPT). The trial programme consisted of two Phase III studies of chronic migraine patients, involving a total of 1384 adults from sites across Europe and North America. It was a 24-week randomised, double blind, placebo controlled phase followed by a 32-week open label phase. The eligible patients were randomised to receive botulinum toxin or placebo administered at 31-39 sites across seven specific muscle groups of the head, neck and shoulders every 12 weeks. The results from the PREEMPT study demonstrated that patients treated with botulinum toxin has experienced a significantly greater reduction in the frequency of migraine days, moderate/severe headache days and cumulative total headache hours on headache days as well as in the frequency of headache episodes and migraine episodes. The treatment related adverse events were consistent with the known tolerability profile of botulinum toxin and there was no newly emerged safety findings were observed. The only adverse events reported in patients receiving botulinum toxin group with an incidence of more than 5% were found to be neck pain (8.7%) and muscular weakness (5.5%). One case of serious treatment related adverse event was reported which resulted in hospitalisation due to migraine.

Though the current studies suggestive of safe and effective use of botulinum toxin for both acute and prophylactic treatment of migraine headaches, but still it remains controversial and the underlying scientific rationale is debatable. So more and more studies with botulinum toxin on migraine headache with a clear mechanism of action are needed to be conducted so as to evaluate their effectiveness, optimal dosing and side effect profile in the treatment of migraine and other headache entities which can ultimately led to significant improvement in their quality of life.

REFERENCES

*1. Assistant Professor, Dept. of Pharmacy Practice, NGSMIPS.
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Mental illness is a wide-encompassing term that includes mood, anxiety, behavioural and psychotic disorders. Pharmacists in tandem with other health care professionals play a very important role in raising awareness and providing care for patients with mental illness. They are actively involved in mental health care in collaboration with physicians, in monitoring and reducing side effects; assessing drug serum concentrations; identifying drug interactions; assisting in the development of treatment plans; and identifying ways to improve medication adherence. Collaborative services of pharmacists over the past three decades in the treatment of individuals with mental illness have shown to have a significant and positive impact on several patient and health system outcomes. Community pharmacists have also been shown to have a significant and positive impact on psychotropic education and monitoring.

As one of the most easily accessible health care professionals, pharmacists are in a unique position to frequently interact with the patient and stress the importance of medication adherence which can have positive impact on treatment outcomes. He is also in a position of advising patients to maintain regular visits with their primary health care provider. When counselling patients, pharmacists should explain to them about the benefits of medication therapy and educate them regarding the possible potential adverse effects associated with their medication.

Patients should be advised not to discontinue any of their medication unless directed by their physician and report to their primary health care provider any side effects that they experience during drug therapy.

Patient should be discouraged from using any other medications, including non-prescription drugs, vitamins, and herbal medications, without seeking advice from their physician. It is also important for patients to be advised against the use of tobacco and alcohol. As quitting smoking may be difficult for patients with mental illness, smoking cessation strategies such as nicotine replacement methods may be recommended.

Success rate in therapy is high when patients have a thorough understanding of their treatment and the importance of medication adherence. Pharmacists have an important role in ensuring adherence by identifying possible contraindications, drug interactions and recommending various strategies that patients can use to overcome them which results in increased adherence to therapy. Encouragement of the patient by the pharmacist in the use of medication reminder devices, automated-refill features and using a single pharmacy for all prescriptions is also a strategy that can be advised.

Most importantly, pharmacists can assist patients by showing empathy, providing encouragement and support and reminding them that adhering to their therapy is the most effective tool in managing illness.

Noncompliance is a problem with some patients once they are discharged from the hospital. It is important for the pharmacist to accurately evaluate the patient’s ability to assume responsibility for taking drugs at home. The administration of antipsychotic drugs becomes a family responsibility if the outpatient appears to be unable to manage his or her own drug therapy. The pharmacist explains any adverse reactions that may occur with a specific antipsychotic drug and encourages the patient or family members to contact the primary health care provider immediately if a serious drug reaction occurs.

Pharmacist advice to the patient and family member should include the following points:

- Ensure regular clinical appointments when necessary, as close monitoring of therapy is essential.
- Report any unusual changes or physical effects to the primary health care provider.
- Take the drug exactly as directed and not to alter, omit or discontinue use of the drug unless directed by the physician.
- Not to drive or perform other hazardous tasks if the prescribed drug is associated with drowsiness.
- Avoid the use of non-prescription drug unless use has been approved by the physician.
- To inform physicians, dentists, and other medical personnel about the present antipsychotic drug therapy during consultations on other medical reasons.
- Not to use alcoholic beverages, cigarette or any other illicit drugs.
- Advise to rise slowly or always take somebody’s help when getting up from the bed or a chair if severe dizziness is associated with the use of the drug.
- Advice to take frequent sips of water, chew a hard candy, or chewing gum (preferably sugarless), to relieve dryness of the mouth due to medication.
- To inform primary care provider in case of pregnancy or intended pregnancy, during drug therapy.

Well-trained Pharmacy professionals are a valuable resource of personals in health care management, yet they are currently underutilized. With a huge deficit in the availability of health care personals, pharmacists should involve themselves in a greater measure, as a part of an interdisciplinary team which will help to provide continuity in medication related services and maximizing pharmacotherapy outcomes.

**References**


*Assistant Professor, Dept. of Pharmacy Practice, NGSMIPS.*
INTRODUCTION
Tuberculosis (TB) is an infectious disease caused by a bacterium called Mycobacterium tuberculosis which mainly affects the lungs, but it can also affect the central nervous system, lymphatic system gastrointestinal tract, genitourinary tract and bones. The therapeutic management is primarily with first line anti-tubercular agents. First line drugs include isoniazid, rifampicin, pyrazinamide, ethambutol and streptomycin. These drugs have proven successful in treating tuberculosis. However, untoward adverse drug reactions to drugs in general have been associated with non-compliance leading to therapeutic failure. It can also lead to prolonged hospital stay and increased healthcare cost. Anti-tuberculosis drugs are no exception to this. Understanding the nature and severity and early identification of these adverse drug reactions allows for appropriate management. Here we present a case report of a male patient who developed acute onset exanthematous febrile illness following treatment with DOTS (Direct Observation Treatment Short course) Category-1 Anti-tubercular therapy for tubercular cervical lymphadenopathy.

CASE REPORT
A 55 year old male, of low socioeconomic status from Mangalore diagnosed in a peripheral clinic with tubercular cervical lymphadenopathy reported to the hospital with acute onset of fever with chills, headache, myalgia, arthralgia and itchy rash on the head, chest, trunk and thighs during the first week of DOTS Category-1 regimen. He was provisionally treated with paracetamol and etoricoxib for flu like febrile illness by a primary care physician. However fever continued to occur every time when he took the DOTS Category-1 drugs. In view of persistent fever, patient requested to be admitted for further evaluation. His white blood cell count was 7900 cells/mm³, erythrocyte sedimentation rate 74mm/hr and liver enzyme levels were SGOT-459 mg/dl and SGPT-159 mg/dl. A similar febrile reaction with maculopapular rashes occurred within 30 minutes following intake of DOTS Category-1 in the hospital. In view of temporal relationship between the drugs and occurrence of febrile illness, DOTS Category-1 was stopped. Patient was treated for his symptoms with antihistamines (oral tablet and lotion for topical application). The rashes and elevated enzyme levels disappeared after 3 days of stopping the anti-tubercular drugs. He was re-challenged with sequential daily dosing of isoniazid followed by rifampicin and ethambutol. Patient tolerated medications well without any fever or rashes. When he was re-challenged with pyrazinamide, rashes reappeared with febrile illness. Pyrazinamide, identified as the culprit drug, was stopped. The rash and fever subsided and was discharged from the hospital with isoniazid, rifampicin, ethambutol and pyridoxine. Patient is maintaining well without any symptoms during the follow up period.

DISCUSSION
Adverse drug reactions are considered to be one of the leading causes for increased morbidity and mortality. Around 5-6% of hospital admissions are estimated to be due to adverse drug reactions and about 6-16% of hospitalized patients experience adverse drug reactions. Incidence of adverse drug reactions is higher in elderly patients receiving polypharmacy for multiple ailments. Inclusion of Pyrazinamide in the first line anti-tubercular regimen has significantly reduced the course of therapy to six months. Gastric effects, liver injury and hyperuricemia are common adverse reactions with pyrazinamide. However, the incidence of cutaneous reaction to pyrazinamide is very rare and exanthematous febrile reaction mimicking flu like illness is not much reported in medical literature. In a case report by Ribi and Hauser, cutaneous skin reaction has been reported following pyrazinamide administration in a patient with active pulmonary tuberculosis. Patient was initiated with a single dose of isoniazid and rifampicin. The other three drugs (pyrazinamide, ethambutol and pyridoxine) were added on the next day. Within minutes, patient developed nausea, dyspnoea and abdominal discomfort, cutaneous flush followed by an itchy rash. The skin eruption disappeared within 24 hours and didn’t recur after sequential re-challenge initially with reduced dose and later by full doses of isoniazid and rifampicin. Patient developed an identical rash within half an hour after administration of 500mg pyrazinamide. Re-challenge with ethambutol was well tolerated and no further reactions were observed with other anti-tubercular drugs. In our case, the patient developed the rash, fever with chills, myalgia, arthralgia and elevated liver enzyme levels after starting first line drugs (isoniazid, rifampicin, pyrazinamide and ethambutol) and disappeared once the regimen was stopped. The SGOT and SGPT levels decreased to 69mg/dl and 93mg/dl on the 3rd day of the hospital stay. The sequential reintroduction with normal dose of isoniazid, rifampicin and ethambutol was well tolerated without any untoward reaction. However, patient experienced febrile reaction with rashes when the pyrazinamide was reintroduced. Pyrazinamide was withdrawn from the regimen and the patient was continued with three anti-tubercular drugs and was discharged from the hospital.

The management of suspected adverse drug reaction needs immediate withdrawal of the offending drug and treatment of the symptoms. In our case, the suspected drug was stopped promptly and antihistamines (oral tablet and topical lotion) were added to manage symptoms.

We carried out the causality assessments as per the Naranjo algorithm and severity and preventability assessments as per the Hartwig scale and according to Schumock and Thornton scale. The causality assessment revealed a “definite” association (Naranjo score 9) between the adverse drug reaction and pyrazinamide. The severity assessment scale revealed adverse drug reaction to be of moderate (level 4), suggesting that the suspected drug be withheld, discontinued, otherwise changed, and/or an antidote or other treatment was required. There was significant increase in the length of hospital stay. Since this patient did not have any past history of exposure to skin reaction due to pyrazinamide or any other drugs, preventability assessment revealed this adverse drug reaction to be ‘not preventable’.

CONCLUSION
Tuberculosis is one of the most common diseases in India. Pyrazinamide along with isoniazid, rifampicin and ethambutol has been used as first line drug in the management of tuberculosis. Pyrazinamide induced dermatological reactions are rare and an exanthematous flu like illness is still rarer and not much reported in the medical literature. This may mislead the doctor for a nonspecific viral illness. Hence such cutaneous reactions are rare and an exanthematous flu like illness is
with anti-tubercular drugs should prompt the physician to consider pyrazinamide as the offending drug and it should be withdrawn from the regimen promptly rather than stopping all the four drugs. This will help in decreasing the prolonged hospital stay and healthcare cost significantly. All patients who are on tuberculosis treatment should be advised about the possibility of cutaneous adverse drug reactions with anti-tubercular drugs and to seek medical advice at the earliest.

REFERENCE:

*1. Assistant Professor, Dept. of Pharmacy Practice, NGSMIPS.
*2. Professor, Dept. of General Medicine, KSHEMA.
*3. Associate Professor, Dept. of General Medicine, KSHEMA.

RECENT ADVANCES IN DRUG DISCOVERY
FDA APPROVED NEW DRUGS

TELAVANCIN HYDROCHLORIDE
A lipoglycopeptide antibacterial that is a synthetic derivative of vancomycin.

Mechanism of Action
Telavancin inhibits cell wall biosynthesis by binding to late-stage peptidoglycan precursors, including lipid II. Telavancin also binds to the bacterial membrane and disrupts membrane barrier function.

INDICATIONS
To reduce the development of drug-resistant bacteria and maintain the effectiveness of Telavancin and other antibacterial drugs.

Telavancin should be used only to treat infections that are proven or strongly suspected to be caused by susceptible bacteria. When culture and susceptibility information are available, they should be considered in selecting or modifying antibacterial therapy. In the absence of such data, local epidemiology and susceptibility patterns may contribute to the empiric selection of therapy.

Combination therapy may be clinically indicated if the documented or presumed pathogens include Gram-negative organisms.

Appropriate specimens for bacteriological examination should be obtained in order to isolate and identify the causative pathogens and to determine their susceptibility to telavancin. Telavancin may be initiated as empiric therapy before results of these tests are known.

DOSAGE AND ADMINISTRATION

Complicated Skin and Skin Structure Infections
The recommended dosing for Telavancin is 10 mg/kg administered over a 60 minute period in patients ≥ 18 years of age by intravenous infusion once every 24 hours for 7 to 21 days. The duration of therapy should be guided by the severity of the infection and the patient’s clinical progress.

SIDE EFFECTS
Nephrotoxicity Infusion-related reactions
Clostridium difficile-associated diarrhea

DRUG INTERACTIONS

Drug-Laboratory Test Interactions
Effects of Telavancin on Coagulation Test Parameters
Telavancin binds to the artificial phospholipid surfaces added to common anticoagulation tests, thereby interfering with the ability of the coagulation complexes to assemble on the surface of the phospholipids and promote clotting in vitro. These effects appear to depend on the type of reagents used in commercially available assays. Thus, when measured shortly after completion of an infusion of Telavancin, increases in the PT, INR, aPTT, and ACT have been observed. These effects dissipate over time, as plasma concentrations of telavancin decrease.

Urine Protein Tests
Telavancin interferes with urine qualitative dipstick protein assays, as well as quantitative dyes (e.g., pyrogallol red-molybdate). However, microalbumin assays are not affected and can be used to monitor urinary protein excretion during Telavancin treatment.

OVERDOSE
In the event of overdosage, Telavancin should be discontinued and supportive care is advised with maintenance of glomerular filtration and careful monitoring of renal function. Following administration of a single dose of Telavancin 7.5 mg/kg to subjects with end-stage renal disease, approximately 5.9% of the administered dose of telavancin was recovered in the dialysate following 4 hours of hemodialysis.

CONTRAINDICATIONS
Telavancin is contraindicated in patients with known hypersensitivity to telavancin.
LENALIDOMIDE
A thalidomide analogue is an immunomodulatory agent with antiangiogenic and antineoplastic properties.

Lenalidomide is available in 2.5 mg, 5 mg, 10 mg, 15 mg, 20 mg and 25 mg capsules for oral administration. Each capsule contains lenalidomide as the active ingredient and the following inactive ingredients: lactose anhydrous, microcrystalline cellulose, croscarmellose sodium, and magnesium stearate. The 5 mg and 25 mg capsule shell contains gelatin, titanium dioxide and black ink. The 2.5 mg and 10 mg capsule shell contains gelatin, FD&C blue #2, yellow iron oxide, titanium dioxide and black ink. The 15 mg capsule shell contains gelatin, FD&C blue #2, titanium dioxide and black ink. The 20 mg capsule shell contains gelatin, FD&C blue #2, yellow iron oxide, titanium dioxide and black ink.

MECHANISM OF ACTION
Lenalidomide is an analogue of thalidomide with immunomodulatory, antiangiogenic, and antineoplastic properties. Lenalidomide inhibits proliferation and induces apoptosis of certain hematopoietic tumor cells including multiple myeloma, mantle cell lymphoma, and del(5q) myelodysplastic syndromes in vitro. Lenalidomide causes a delay in tumor growth in some in vivo nonclinical hematopoietic tumor models including multiple myeloma. Immunomodulatory properties of lenalidomide include activation of T cells and natural killer (NK) cells, increased numbers of NKT cells, and inhibition of pro-inflammatory cytokines (e.g., TNF-α and IL-6) by monocytes.

In multiple myeloma cells, the combination of lenalidomide and dexamethasone synergizes the inhibition of cell proliferation and the induction of apoptosis.

INDICATIONS
Multiple Myeloma
Lenalidomide in combination with dexamethasone is indicated for the treatment of patients with multiple myeloma (MM) who have received at least one prior therapy.

Myelodysplastic Syndromes
Lenalidomide is indicated for the treatment of patients with transfusion-dependent anemia due to low- or intermediate-1-risk myelodysplastic syndromes (MDS) associated with a deletion 5q cytogenetic abnormality with or without additional cytogenetic abnormalities.

Mantle Cell Lymphoma
Lenalidomide is indicated for the treatment of patients with mantle cell lymphoma (MCL) whose disease has relapsed or progressed after two prior therapies, one of which included bortezomib.

SIDE EFFECTS
- Neutropenia and thrombocytopenia
- Deep vein thrombosis and pulmonary embolism
- Allergic Reactions
- Tumor lysis syndrome
- Tumor flare reactions
- Hepatotoxicity
- Second Primary Malignancies

OVERDOSE
There is no specific experience in the management of lenalidomide overdose in patients; although in dose-ranging studies, some patients were exposed to up to 150 mg and in single-dose studies, some patients were exposed to up to 400 mg.

FERRIC CARBOXYMALTOSE
Ferric carboxymaltose, an iron replacement product, is an iron carbohydrate complex with the chemical name of polynuclear iron (III) hydroxide 4(R)-(poly-(1α,4)-O-α-Dglucopyranosyl)-oxy-2(R),3(S),5(R),6-tetrahydroxy-hexanoate.

Ferric carboxymaltose injection (Injacter) is a dark brown, sterile, aqueous, isotonic colloidal solution for intravenous injection. Each mL contains 50 mg iron as ferric carboxymaltose in water for injection. Injacter is available in 15 mL single-use vials. Sodium hydroxide and/or hydrochloric acid may have been added to adjust the pH to 5.0-7.0.

MECHANISM OF ACTION
Ferric carboxymaltose is a colloidal iron (III) hydroxide in complex with carboxymaltose, a carbohydrate polymer that releases iron.

INDICATIONS
Injacter is indicated for the treatment of iron deficiency anemia in adult patients;
who have intolerance to oral iron or have had unsatisfactory response to oral iron;
who have non-dialysis dependent chronic kidney disease.

DOSAGE AND ADMINISTRATION
For patients weighing 50 kg (110 lb) or more: Give Injacter in two doses separated by at least 7 days. Give each dose as 750 mg for a total cumulative dose not to exceed 1500 mg of iron per course.

For patients weighing less than 50 kg (110 lb): Give Injacter in two doses separated by at least 7 days. Give each dose as 15 mg/kg body weight for a total cumulative dose not to exceed 1500 mg of iron per course.

The dosage of Injacter is expressed in mg of elemental iron. Each mL of Injacter contains 50 mg of elemental iron. Injacter treatment may be repeated if iron deficiency anemia reoccurs.

Dosage Forms and Strengths
750 mg iron / 15 mL single-use vial

Storage and Handling
NDC 0517-0650-01 750 mg iron/15 mL Single-Use Vial Individually boxed NDC 0517-0650-02 750 mg iron/15 mL Single-Use Vial Packages of 2 Store at 20°C to 25°C (68°F to 77°F); excursions permitted to 15°C to 30°C (59°F to 86°F). Do not freeze.

SIDE EFFECTS
- Hypersensitivity Reactions
- Hypertension
- Lab test alterations

PRECAUTIONS
- Hypersensitivity Reactions
- Serious hypersensitivity reactions, including anaphylactic-type reactions,
some of which have been life-threatening and fatal, have been reported in patients receiving Injectafer. Patients may present with shock, clinically significant hypotension, loss of consciousness, and/or collapse. Monitor patients for signs and symptoms of hypersensitivity during and after Injectafer administration for at least 30 minutes and until clinically stable following completion of the infusion. Only administer Injectafer when personnel and therapies are immediately available for the treatment of serious hypersensitivity reactions.

OVERDOSE
Excessive dosages of Injectafer may lead to accumulation of iron in storage sites potentially leading to hemosiderosis. A patient who received Injectafer 18,000 mg over 6 months developed hemosiderosis with multiple joint disorder, walking disability and asthenia. Hypophosphatemic osteomalacia was reported in a patient who received Injectafer 4000 mg over 4 months. Partial recovery followed discontinuation of Injectafer.

CONTRAINDICATIONS
Hypersensitivity to Injectafer or any of its components

THE TRAINING ARENA

K.S. Hegde Charitable Hospital

Department of Pharmacy Practice

Drug Information Center

Out Patient Dispensing Counter

Dispensing and Retail Pharmacy

Ward Round Participation with Physicians

Library and Case Presentation Facility
Health Science Institutions
- K.S Hegde Medical Academy, Mangalore.
- AB Shetty Memorial Institute of Dental Sciences, Mangalore.
- K.S. Hegde Hospital, Mangalore.
- Nitte Meenakshi Institute for Craniofacial Surgery, Mangalore.
- Nitte Gulabi Shetty Memorial Institute of Pharmaceutical Sciences, Mangalore.
- Nitte Usha Institute of Nursing Sciences, Mangalore.
- Nitte Institute of Physiotherapy, Mangalore.
- Nitte Institution of Medical Laboratory Sciences, Mangalore.
- Nitte Institute of Speech & Hearing, Mangalore.

Engineering Institutions
- Nitte Mahalinga Adyanthaya Memorial Institute of Technology, Nitte.
- Nitte Meenakshi Institute of Technology, Bangalore.

Management Institutions
- Justice K.S Hegde Institute of Management, Nitte.
- Sarosh Institute of Hotel Administration, Mangalore.
- Nitte School of Management, Bangalore.

Technical Institutions
- Nitte Rukmini Adyanthaya Memorial Polytechnic, Nitte.
- Mulki Ramakrishna Punja Industrial Training Institute, Thokur.
- Nitte Industrial Training Centre, Bangalore.

Science & Commerce Institutions
- Dr Nitte Shankara Adyanthaya Memorial First Grade College, Nitte.
- Dr Nitte Shankara Adyanthaya Memorial First Grade College, Bangalore.
- Dr Nitte Shankara Adyanthaya Memorial College, Mangalore.
- Dr Nitte Shankara Adyanthaya Memorial Pre-University College, Nitte.
- Dr Nitte Shankara Adyanthaya Memorial Pre-University College, Mangalore.

Schools
- Nitte International School, Bangalore.
- Dr Nitte Shankara Adyanthaya Memorial English Medium High School, Nitte.
- Dr Mundkur Ramanna Shetty Memorial English Medium High School, Thokur.
- Dr Nitte Shankara Adyanthaya Memorial Higher Primary School, Bolakodi.