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Drug Related Problems In Department of Neurology,Nephrology And Pulmonology

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Abstract

Objective: To assess the drug related problems in department of neurology, nephrology and pulmonology.

Drug related problem is defined as an extent or circumstance involving drug treatment that actually or potentially interferes with the patient experiencing an optimum outcome of medical care. Drug Related Problems are two types one is actual Drug Related Problem and another is potential Drug Related Problem. Classification of Drug Related Problems include adverse drug reaction, drug interaction, failure to receive drug, sub therapeutic dosage, over dosage, indication without drug therapy, drug use without indication, inappropriate drug selection. To resolve the Drug Related Problems by the aware of these problems and efforts must be made by clinical pharmacist. Clinical pharmacist has a significant role in identification, prevention and management of the drug related problems like adverse drug reactions, drug interactions, poly pharmacy and non-compliance to the medications etc… among neurology, nephrology and pulmonology departments.

Keywords: Drug Related Problem (DRP), Adverse Drug Reaction (ADR), Chronic Obstructive Pulmonary Disease (COPD), Chronic Kidney Disease (CKD)

1. Introduction

Drug related problem (DRP) is defined as an extent or circumstance involving drug treatment that actually or potentially interferes with the patient experiencing an optimum outcome of medical care [1]. DRPs can increase the carrying cost and also can block the attained of the therapy purposed [2]. One of the factors for identifying DRPs is use of electronic prescription and for improving the drug safety [3]. The core process of pharmaceutical care is identification, prevention and solution of DRPs [4]. The purpose of identifying DRPs is to realize the best possible outcomes from drug therapy and help to the patients achieve their goals of therapy [5]. Therefore, through knowledge of DRPs may benefit health care professionals including pharmacists to identify DRPs, resolve actual DRPs and prevent potential DRPs in order to optimise patients' outcomes [6].50-80 % of the drug related problems can be prevented by pharmacist intervention [7].

There are two types of DRPs: Actual DRP and potential DRP

Actual DRP: An actual drug related problem is defined as an event which is already seen in patients due to the drugs which are administered without involvement of pharmacist.

Potential DRP: Potential drug related problem is defined as an event that occurs in the absence of pharmacist intervention.

The most important drug related problems include adverse drug reactions (ADRs), drug interactions (DIs) and therapeutic failure [8].

2. Types of drug related problems:

HELPER AND STRANDS classified the DRPs into 8 categories: [9]

A. Adverse drug reaction (ADR)
B. Drug interaction (DI)
C. Failure to receive drug
D. Sub therapeutic dosage
E. Over dosage
F. Indication without drug therapy
G. Drug use without indication
H. Inappropriate drug selection

I. **Adverse drug reaction (ADR):**According to WHO an adverse drug reaction (ADR) is defined as a response to a drug which is noxious and unintended and which occurs at doses normally used in man for the prophylaxis, diagnosis or therapy for a disease and for the modification of function excluding failure to accomplish the intended purpose. Drug administration either alone or combination can leads to ADR. When the number of medications administered increases the frequency of ADR increases [10].ADRs are major cause for morbidity and it accounts mostly 5% of hospitalised patients all over the world. ADRs are 4th leading cause of death in pulmonary disease, diabetes mellitus, AIDS, pneumonia and automobile death conditions [10]. Ex: theophylline induced anxiety and seizure [10]; methylxanthines induced hypokalaemia [11].

II. Drug interactions (DIs):

Drug-drug interaction: Drug-drug interaction can be defined as a change in a drugs effect on the body when the drug is taken together with a second drug [12].A drug-drug interaction can delay, decrease, or enhance absorption of either drug. This can decrease or increase the action of either or both drugs or cause adverse effects [11]. More number of drugs prescribed in elderly patients is more prone to drug-drug interactions. Patient factors, prescriber factors, and communication between health professional and patient are the risk factors for drug-drug interactions [13]. Interactions can be prevented by avoiding multiple drug treatment and potential benefits of drug combination [13]. Ex: combination of linezolid and theophylline, linezolid may enhance the hypertensive effect of sympathomimetic [11], combination of amlodipine and labetalol cause brady cardia [12]. Drug-drug interactions include Pharmacokinetic interactions and pharmaco dynamic interactions. Pharmaco dynamic interactions are mainly synergism, antagonism and additive effect; synergistic is one of the most pharmacodynamic interactions [14]. Ex: efficacy of inhaled corticosteroids might be reduced in patients with asthma and COPD. Higher doses of inhaled corticosteroids are required in patients with asthma who smokes [15].Pharmacokinetic type of interaction which affects the drug absorption, distribution, metabolism and elimination. The most pharmacokinetic interaction is metabolism [14]. Ex: smoking and theophylline; theophylline has a narrow therapeutic window dose adjustment is done in the smoking patients [15].

Drug-food interaction: Drug-food interactions occur when food and medicine interfere with one another.

Interactions can happen both prescription and over the counter medicines. These include antacids, vitamins and iron pills [16]. Interaction between food and drugs can produce negative effects in safety and efficacy of drug therapy and nutritional therapy. They may increase or decrease the drug effect. Taking one hour before or 2 hours after eating interactions can be avoided [14]. Ex: while taking ACE inhibitors potassium containing foods are avoided like banana, sweet potato etc... [16].

Drug-disease interaction: Drug-disease interaction is an event in which a drug intended for therapeutic use causes some harmful effect in a patient because of disease or condition that the patient has. There are some diseases that alter the body ability to metabolize or breakdown, a drug so that it can have the intended effect [17]. These interactions can occur in any age group people but more common in elderly people and who are having a greater number of diseases. For example, beta blockers are taken for hypertension can worsen the asthma [18].

III. Failure to receive drug

Failure to receive drug is defined as a deviation from the prescribed medications because of a choice, non-comprehension or forgetfulness [19]. Ex: Iron preparations, multivitamins, paracetamol, phenytoin [7].

IV. Subtherapeutic dosage: It can be defined as if the prescribed dose was less than recommended dose [19]. Ex: according to indication or guidelines; budesonide inhaler -pregabalin [20], amoxicillin-calcium [19], telmisartan-metoprolol [7].

V. Over dosage: Over dosage can be defined as if the prescribed dose was too high in relation to the patient's renal function, liver function or age; Ex: Gabapentin and allopurinol dose was not adjusted in renal function patients.

VI. Indication without drug therapy: If a patient had an unnecessary drug therapy this was classified as indication without drug therapy [19].Ex: calcium and vitamin D, omeprazole, potassium, prednisolone [20].

VII. Drug use without indication: Inappropriate drug use according to explicit Swedish criteria and inappropriate drugs according to renal function or disease were classified as inappropriate or ineffective drug. Ex: anti-diabetic agents like Metformin and Glibenclamide [19].

3. Drug related problems in pulmonology department: Pulmonology department diseases include asthma, COPD and tuberculosis. Asthma is a global health problem that imposes a substantial burden on patients, their families, and communities. It affects an estimated 300 million individuals worldwide [5].

Asthma: is a chronic inflammatory disorder of the airways in which many elements play a role such as mast cells, eosinophils, neutrophils, T-lymphocytes, macrophages and epithelial cells. Symptoms include wheezing, breathlessness, chest tightness and coughing [21].

COPD is most common respiratory illness in the world in 2016 COPD was 4th leading cause of death in middle income countries. In 2030 this may be a third leading cause of death [22]. As per global initiative for chronic obstructive lung disease (GOLD) guidelines, COPD is a common preventable and treatable disease that is characterized by persistant respiratory symptoms and airflow limitation due to air way or alveolar abnormalities. Symptoms of COPD are wheezing shortness of breath, cough with sputum production, generalized fatigue, and frequent infections [11].

Tuberculosis

Tuberculosis is a chronic infectious disease. One of the leading cause of mortality and morbidity around the world, approximately 8 million people with an annual death. INDIA shares almost a 3rd of this global TB burden [2].TB is caused by mycobacterium tuberculosis that most often affect the lungs. Common symptoms of active lung tb are cough with sputum and blood at times, chest pain, weakness, weight loss, fever and night sweats [23]. Mostly drug related problems involved in the pulmonology department are drug interactions(drug-drug interaction, drug -disease interaction and drug food interaction), adverse reactions poly pharmacy, non-adherence, drug choice problem, incomplete data, spelling mistakes, frequency error, eligible data, inappropriate use of drugs like antibiotics and acid suppressant drugs. More than quarter of the drug therapy problems is seen with artemether-lumefantrine and vitamin C, as well as aminophylline and hydrocortisone combination. The following are few examples of DRPs found in departments of pulmonology.

Table 1: Drug-drug interactions in department of Pulmonologist [5 & 14]

S.no.	**Name of drug**	**Drug therapy problem**
1.	Aminophylline and cimetidine	Cimetidine inhibits the metabolism of aminophylline
2.	Aminophylline and hydrocortisone	Plasma concentration is increased by hydrocortisone
3.	Artemether / lumefantrine and vitamin C	Vitamin C inhibits the oxidation of artemisinin derivative
4.	Artemether / lumefantrine and cimetidine	Cimetidine inhibits the metabolism of artemether or lumefantrine
5.	Inj.ranitidine and inj.theophylline	Theophylline toxicity (nausea, vomiting,palpitations)
6.	Inj.furosemide and inj. Hydrocortisone	Results in hypokalemia
7.	Inj.ciprofloxacin and inj.theophylline	Theophylline toxicity (nausea, vomiting, palpitations)

Table 2: Drug-food interactions in department of pulmonology [14]

S.no.	Name of drug	Drug related problem
1.	Theophylline and coffee or tea	Increase plasma concentration by inhibiting metabolism
2.	Theophylline and protein rich foods (fish,milk,egg ,meat)	Increased clearance of the drug

Table 3: Drug-disease interactions in department of pulmonology [14]

S.no.	Name of drug	Drug therapy problem
1.	Diazepam-COPD	Risk of respiratory depression
2.	Chlorpheniramine-COPD	Reduce the volume and cause thickening of bronchial secretion, resulting in obstruction of respiratory tract

Table 4: Adverse drug reactions in department of pulmonology [2 & 11]

S.no.	Name of drug	Drug therapy problem
1.	Budesonide	Decreased urine output
2.	Hydrocortisone	Generalized weakness and decreased sleep
3.	Levosalbutamol	Burning micturition
4.	Theophylline	Tachycardia
5.	Salbutamol	Dry mouth,hypokalemia, muscle pain, increased heart rate, heart burn, muscle tremor
6.	Isoniazid, rifampicin, pyrazinamide	Elevation of LFT
7.	Chloramphenicol	Anemia

4. Drug related problems in neurology department:

Neurology department diseases include stroke, Parkinsonism, epilepsy, dementia. Stroke is one of the leading cause of the death and the major cause of disability among the elderly; it has been ranked as 3rd deadliest medication worldwide. According to the report of World Health Organization (WHO) 15 million people world wide suffer from stroke every year of this 5 million die and another 5 million are left permanently disabled placing a burden in family and community [24].Stroke is classically characterized as a

neurological deficit attributed to an acute focal injury of the CNS by a vascular cause, including cerebral infarction, intracerebral haemorrhage and subarachnoid haemorrhage is a major cause of disability and death worldwide [25]. Symptoms include facial droop, arm drop, speech disturbances and time [26].

Parkinson disease is a neuro degenerative disorder which leads to progressive deterioration of motor function due to loss of dopamine producing brain cells. Symptoms include tremor, stiffness, slowness, impaired balance [27].

Epilepsy is a chronic disorder of the brain and is one of the most common serious neurological disorder effective 50 million people worldwide with no boundary to age, race, nationality and geographical concentration [28].an epileptic seizure is a transient occurrence of signs and symptoms due to abnormal excessive or synchronous neuronal activity in the brain [29].

Dementia is a syndrome usually of a chronic or progressive nature in which there is deterioration in cognitive function beyond what might be expected from normal aging it affects memory, thinking, orientation, comprehension, calculation, learning capacity, language and judgment [30].

Mostly drug related problems involved in neurology department are drug interaction, non-adherence, adverse drug reaction and the remaining drug related problems include drug use without indication, medication error, improper drug selection, untreated indication, sub therapeutic dose, over dose, failure to receive the drugs, drug duplication [7].

Table 5: Drug-drug interactions in department of neurology [3]

S.no.	Name of drug	Drug therapy problem
1.	Clopidogrel and esomeprazole	Reduction in clopidogrel efficacy
2.	Aspirin and ibuprofen	Reduction in aspirin efficacy
3.	Domperidone and atypical neuroleptics	Increase risk of torsade de pointes
4.	Zolpidemand lorazepam	Over sedation
5.	Meropenemand valproic acid	Loss of seizure control
6.	Escitalopram and tramadol	Increase risk of seizures
7.	Phenytoin and paracetamol	Increase paracetamol induced hepatotoxicity

5. Drug related problems in nephrology department:

Nephrology department diseases include chronic kidney disease (CKD). Kidney disease is one of the health problems requiring early detection and treatment to prevent its progression in accordance to reports from WHO genitourinary diseases including kidney diseases contributed to more than 26 million disability adjusted life years and the responsible for approximately 800000 mortality cases each year worldwide [6].

CKD: is defined as kidney damage lasting for greater than 3 months characterized by structural or functional abnormality of the kidney, with or without decreased glomerular filtration rate [31].advanced age, family history, diabetes mellitus, hypertension and tobacco smoking are the several risk factors for CKD.

Mostly drug related problems in nephrology department are polypharmacy, prescription error, and non-adherence.

The most prescribed anti-hypertensive drug is amlodipine and the remaining drugs were cilnidipine, nifedipine, verapamil and diltiazem. Beta blockers are the second widely prescribed antihypertensive drugs.

Lisinopril could increase the serum potassium levels while furosemide decreases serum potassium levels.

These drugs can cause nephrotoxicity; hence renal function monitoring is required.

Majority of drug-drug interactions are seen with these drugs like aspirin and clopidogrel, aspirin and torsemide, atorvastatin and clopidogrel, aspirin and calcium.

In stage 5 CKD and hypertensive patients mostly potential drug-drug interactions are seen [8].

Table 6: Severe drug-drug interactions in department of nephrology [9]

S.no.	Name of drug	Drug therapy problem
1.	Linezolid and tramadol	Linezolid increases the toxicity of tramadol and shows increase the risk of hypertension, hyperpyrexia, somnolence
2.	Methyl prednisolone and ofloxacin	May potentiate risk of tendon rupture
3.	Atenolol and clonidine	Increase risk of sinus bradycardia

Table 7: Moderate drug-drug interactions in department of nephrology [9]

S.no.	Name of drug	Drug therapy problem
1.	Aspirin and insulin	Aspirin may increase the hypoglycemic effect of insulin
2.	Aspirin and prednisolone	Increase the risk of GI ulceration
3.	Caco3 and nifedipine	Decrease the effect of nifedipine
4.	Inj.Pantoprazole and cefuroxime	Will decrease the effect of cefuroxime
5.	Sevelamer and gabapentin	Decrease the effect of gabapentin

Table 8: Adverse drug reactions in department of nephrology [1]

S.no.	Name of drug	Drug therapy problem
1.	Clonidine	Drowsiness, giddiness and dry mouth
2.	Multivitamin	Insomnia
3.	Amlodipine	Headache, hypotension and dry mouth
4.	Sevelamer	GI ulceration
5.	Insulin	Tiredness
6.	Prazosin	Hypotension
7.	Iron sucrose	Chills

6. Conclusion

Clinical pharmacist has a significant role in identification, prevention and management of the drug related problems like adverse drug reactions, drug interactions, polypharmacy and non-compliance to the medications in neurology, nephrology and pulmonology departments. Regular assessment of prescribing medications and management of therapy in these departments can decrease the drug related problems which helps in decreasing health care costs and providing better treatment outcome with improved quality of life [3&32].

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