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A Prospective Study on Prescription Analysis of Anaemic Condition with Pharmacist Intervention at Tertiary Care Hospital

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ABSTRACT

As per the World Health Organization (WHO), anaemia is defined as a condition in which the number of red blood cells gets decreased which leads to decreased levels of haemoglobin (Hb). The study provides an overview of the prescription analysis of anemic condition with pharmacist intervention in tertiary care hospital. This study was conducted in the duration of 6 months (August 2017-January 2018) which includes patients of different conditions based on their range of haemoglobin categorized according to age, gender, and social habits. Our results imply that initially patients were found to be anemic at the time of admission but the anemic condition is not treated as they concentrated more on treating the pathological condition and according to prescription analysis we found that they became more anemic during the treatment process which may be due to their pathological condition such as Chronic kidney disease (CKD), Coronary artery disease (CAD), cancer, Chronic liver disease (CLD) or due to the usage of prescribed drugs like antibiotics, analgesics, NSAID's. The observed disease conditions and the drugs may also show significance in the occurrence of anaemia and in most of the prescriptions appropriate treatment for anaemia was not provided during the hospital stay which includes our intervention regarding the study. As per the literature females were prone to be anemic, surprisingly in our hospital study we have found that males were found to be anemic in the age group of 25-64 years in mild anemic category (10-14 g/dl), whereas in the moderate (8-10 g/dl), severe (6.5-8 g/dl) and life-threatening (>6.5 g/dl), female cases were more.

Keywords: Anaemia, Haemoglobin , Pathological conditions, Drug-induced

INTRODUCTION

As per World Health Organisation (WHO), anaemia is defined as a condition in which the number of red blood cells gets decreased which leads to decreased levels of haemoglobin (Hb) content or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, smoking, and pregnancy status. Among the different types of anaemia, iron deficiency anaemia is thought to be the most common cause of anaemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infestations, and inherited disorders can cause anaemia. In its severe form, it is associated with fatigue, weakness, dizziness, and drowsiness. Pregnant women and children are particularly vulnerable [1]. Our study is an observational study which is carried out to identify the prevalence of anaemia in patients by categorizing them according to their age, gender, social habits, disease condition, range of haemoglobin (Hb) and prescription analysis is carried out to find the significance of drugs in anaemia at a tertiary care hospital. Our study provides patient safety and advised the patients regarding dietary modifications required to overcome the anaemic condition.

Literature Review

Tsirakis, et al., stated in their article that anaemia is prevalent in patients with Chronic heart failure (CHF) but the exact rates vary widely [2]. A recent meta-analysis of 153,180 patients with CHF, reported in 34 published studies from 2001-2007, estimated the prevalence of anaemia to be 37.2% (10%-49%). Similarly, the latest prospective STAMINA-HFP (Study of Anaemia in a Heart Failure Population) registry estimated a prevalence of 34%.

The renin-angiotensin system seems to be involved in the control of erythropoiesis. Angiotensin II reduces renal blood flow, increases the oxygen demands, and thereby stimulates EPO production. It also stimulates the proliferation of normal bone marrow early erythroid progenitors in a direct manner. Both ACE inhibition and angiotensin receptor blockade decrease erythropoiesis which leads to anaemia [2] (Figure 1).

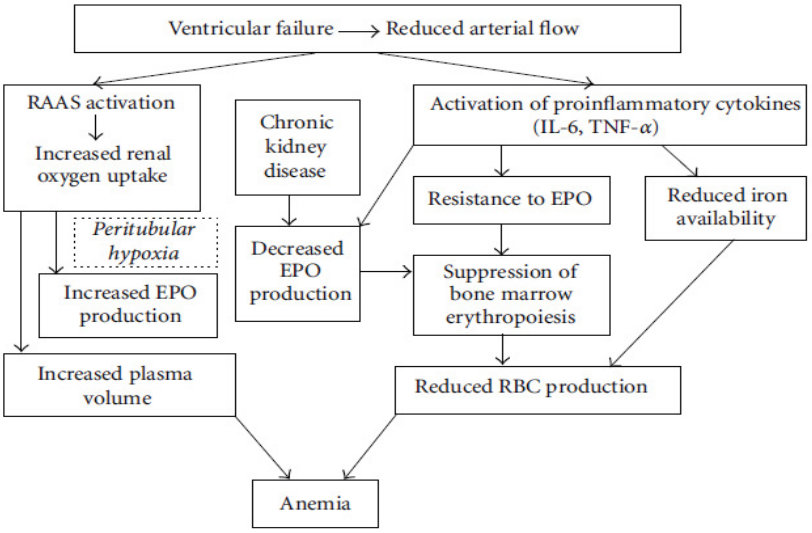

Figure 1 Mechanism of anaemia in patients with CHF

Lin, et al., studied the mechanisms of anaemia in Chronic kidney disease (CKD) which states that iron and EPO are crucial for red blood cell production in the bone marrow. Iron availability is controlled by the liver hormone hepcidin, which regulates dietary iron absorption and macrophage iron recycling from senescent red blood cells. In CKD patients (particularly in end-stage kidney disease patients on hemodialysis), hepcidin levels have been found to be highly elevated, presumably due to reduced renal clearance and induction by inflammation, leading to iron-restricted erythropoiesis. CKD also inhibits EPO production by the kidney, and may also lead to circulating uremic-induced inhibitors of erythropoiesis, shortened red blood cell lifespan, and increased blood loss [3] (Figure 2).

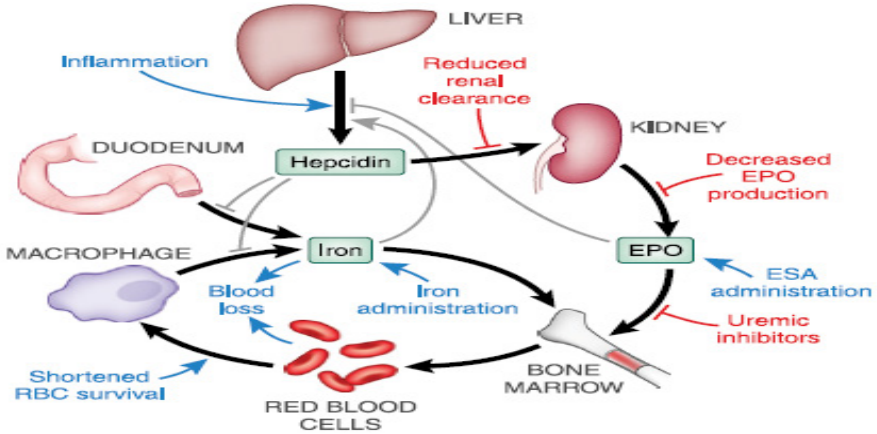

Figure 2 Mechanism of anaemia in patients with CKD

Stauffer, et al., states that anaemia is one of the many complications of Chronic kidney disease (CKD). However, the current prevalence of anaemia in CKD patients in the United States is not known. Data from the National Health and Nutrition Examination Survey (NHANES) in 2007-2008 and 2009-2010 were used to determine the prevalence

of anaemia in subjects with CKD. The analysis was limited to adults aged 18 years who participated in both the interview and exam components of the survey. Three outcomes were assessed: the prevalence of CKD, the prevalence of anaemia in subjects with CKD, and the self-reported treatment of anaemia. CKD was classified into 5 stages based on the glomerular filtration rate and evidence of kidney damage, in accordance with the guidelines of the National Kidney Foundation. Anaemia was defined as serum haemoglobin levels 12 g/dL in women and 13 g/dL in men. We found that an estimated 14.0% of the US adult population had CKD in 2007-2010. Anaemia was twice as prevalent in people with CKD (15.4%) as in the general population (7.6%). The prevalence of anaemia increased with stage of CKD, from 8.4% at stage 1 to 53.4% in stage 5. A total of 22.8% of CKD patients with anaemia reported being treated for anaemia within the previous 3-months, 14.6% of patients at CKD stages 1-2 months and 26.4% of patients at stages 3-4 months. These results update our knowledge of the prevalence and treatment of anaemia in CKD in the United States [4].

Garratty, et al., studied on Drug-induced immune hemolytic anaemia (DIIHA) which involves drugs like Piperacillin, Ceftriaxone, Cefotetan which can most frequently cause DIIHA. With regard to the drug-dependent mechanisms, one mechanism is universally accepted. Some drugs bind covalently to proteins on the RBC membrane; thus, if conditions are optimal (e.g., high enough drug concentration), circulating RBCs will be coated with drug; this does no harm to the RBCs, but if the patient makes an IgG antibody to the drug the antibody will bind to the drug on the RBC and the macrophages can interact, leading to Fc Mediated extravascular RBC destruction; complement may, on occasion, also be involved. These antibodies are easily detectable *in vitro* by testing the patient's serum or an eluate from the RBCs against drug-coated RBCs (prepared *in vitro*). The prototype drug is penicillin; cefotetan, but not ceftriaxone, which can react by this mechanism [5].

Le, et al., states that these findings provided an updated snapshot of anaemia in the US general population and in subgroups divided by gender, age, race/ethnicity, over years, and severity. The prevalence of anaemia has increased over the study period from 2003-2012. High-risk groups for anaemia and moderate-severe anaemia include the elderly, reproductive-age and pregnant women, Hispanics, and non-Hispanic blacks [6].

Kucera, et al., states that the pharmacist has a critical role in the treatment of patients with anaemia [7]. Pharmacists can assist patients with therapy management, particularly in areas of iron administration, dietary recommendations, drug interactions with oral iron, and medications that can exacerbate conditions. As pharmacists, we should also be aware of the signs and symptoms of anaemia in order to assess the efficacy of treatment and refer those patients who need to seek medical attention. Pharmacists can utilize their extensive pharmacological knowledge to increase positive outcomes [7].

MATERIALS AND METHODS

Approval of the Protocol by IEC

The protocol for the proposed study was submitted to the Institutional Ethics Committee (IEC) of Nirmala College of Pharmacy, Mangalagiri, Guntur, Andhra Pradesh. The protocol was approved by the IEC on 'A prospective study on prescription analysis of anaemic condition in tertiary care hospital'.

Research Design

A hospital-based prospective and observational study were conducted in the various departments of tertiary care hospital, Vijayawada, India for about 6 months (October 2017-March 2018), in which 130 anemic cases were collected from the inpatient wards. Inclusion criteria include the patients of all different age groups, irrespective of their disease condition of both genders getting admitted to the study site during the study period. Exclusion criteria include those who were unable or unwilling to participate in the study and outpatients. The source of data includes patient case sheets, treatment chart, laboratory report, patient or caretaker interview and other relevant data sources.

Experimental Work

Our study involves the collection of 130 anaemic cases with different disease conditions of patients with all age groups along with the Hb values on the date of their admission. We categorized the patients based on their age groups, sex, social habits, Hb values, and diagnosis which show the increased no of anaemic cases in Chronic kidney disease (CKD), Coronary artery disease (CAD), cancer, and Chronic liver disease (CLD) respectively in the following collected cases. By carrying out the prescription analysis no of antibiotics, antacids, anti-hypertensive, analgesics, corticosteroids, etc respectively were found to be more in the prescriptions collected.

RESULTS

Out of 130 anemic prescriptions, 67 were found to be males and 63 were found to be females.

In Table 1 and Figure 1 we divided the patients based on their age into 4 categories like children (1-14 years), youth (15-24 years), adults (25-64 years), and seniors (>65 years) in which adults (61.5%) were found to be more in no followed by seniors (22.3%), youth (10%), and children (6.15%) respectively.

Table 1 Percentage of different age groups included in the study

Age (Years)	No of Patients	Percentage of Patients (%)
1-14 (children)	8	6.153%
15-24 (youth)	13	10.000%
25-64 (adults)	80	61.538%
>65 (seniors)	29	22.307%

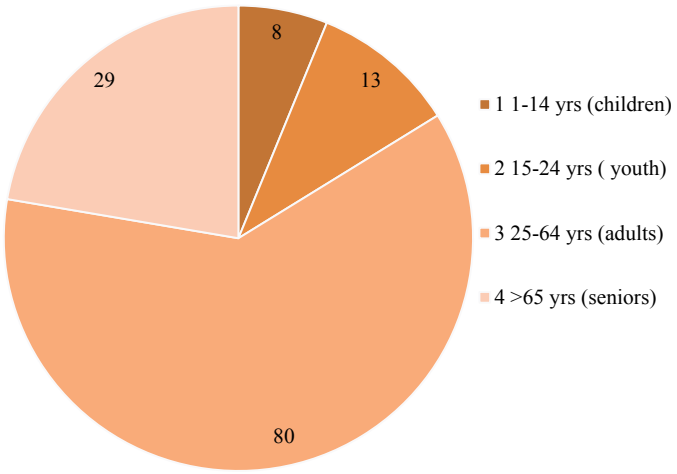

Figure 1 Percentage of different age groups included in the study

In Table 2 and Figure 2, patients were divided based on their gender in which males (51.53%) were found to be more when compared with the females (45.86%).

Table 2 Percentage of the gender distribution of patients

Total no of patients	Male	Female	Percentage (%)	
			Male	Female
130	67	63	51.53%	48.56%

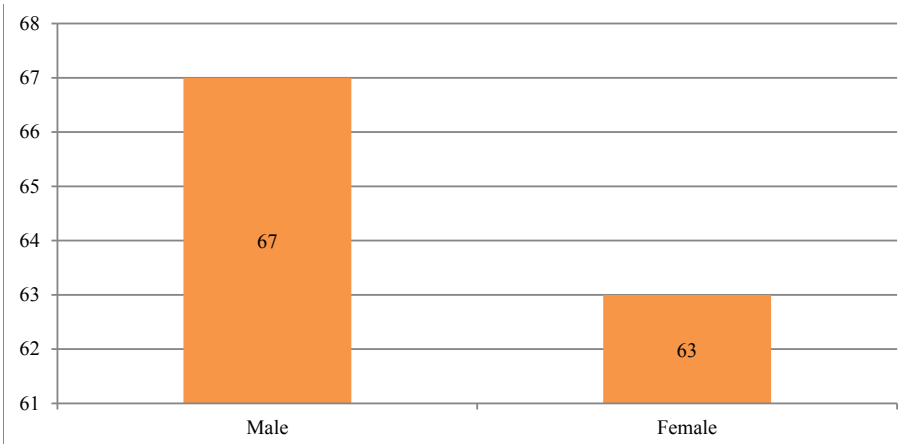

Figure 2 Percentage of the gender distribution of patients

In Table 3 and Figure 3, the number of patients was divided based on their diagnosis which shows a higher number of patients in CKD (16.15%) followed by CAD (15.38%), fever (10%), cancer (7.69%), CLD (6.15%) respectively.

Table 3 Percentage of patients with a different diagnosis

Disease	No of Patients	Percentage of Patients (%)
Cancer	10	7.69%
Pancreatitis	4	3.07%
Chronic kidney disease (CKD)	8	6.15%
Gastro esophageal reflux disease (GERD)	1	0.76%
Bilateral Knee arthritis	5	3.84%
Anaemia	7	5.38%
Fever	13	10.00%
Transient ischemic attack (TIA)	1	0.76%
Gangrene, Diabetes Mellitus (DM)	6	4.61%
Heart disease (CAD, CHF)	20	15.38%
CKD	21	16.15%
Cellulitis	3	2.30%
Appendectomy	1	0.76%
Chronic Obstructive Pulmonary Disease (COPD)	4	3.07%
Cholecystitis	1	0.76%
Urinary Tract Infection (UTI)	4	3.07%
Uterine bleed	2	1.53%
Alcoholic Liver Disease (ALD)	2	1.53%
Colitis	1	0.76%
Chronic duodenal ulcer	1	0.76%
Sub acute intestinal obstruction	1	0.76%
Drug overdose	1	0.76%
left parietal gleoma	1	0.76%
Left cavernous sinus thrombosis	1	0.76%
Upper GastroIntestinal (GI) bleed	1	0.76%
Cholelithiasis	1	0.76%
Benign Prostatic Hypertrophy (BPH)	1	0.76%
Fibrous Tumor of the Pleura (FTP)	1	0.76%
Fibroid uterus	1	0.76%
Vertigo, stroke with hyponatremia	1	0.76%
Idiopathic Thrombocytopenic Purpura (ITP)	3	2.30%
Tuberculosis (TB) with pneumonia	1	0.76%
Diabetes Mellitus (DM) with hypoglycemia	1	0.76%

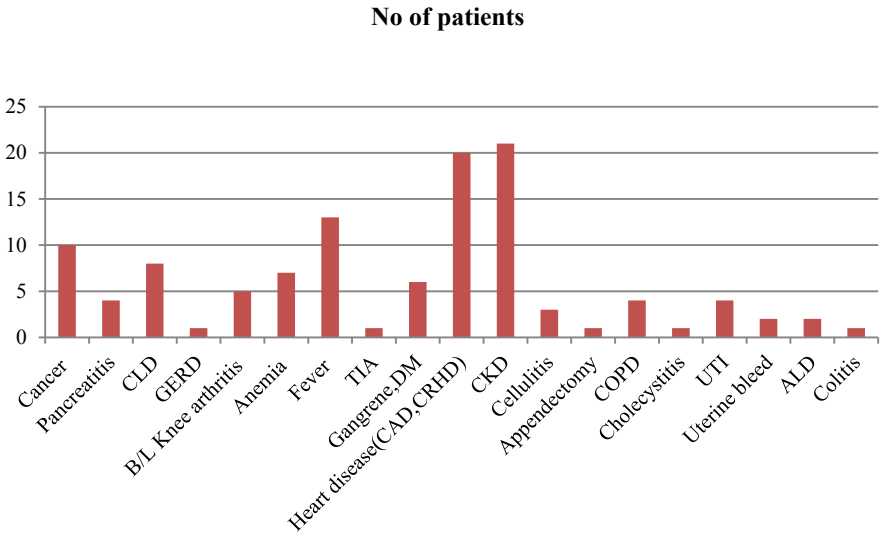

Figure 3 Percentage of patients with a different diagnosis

In Table 4 and Figure 4, the patients were divided based on the range of haemoglobin (Hb) into 4 groups like mild (10-14 g/dl), moderate (8-10 g/dl), severe (6.5-8 g/dl), life-threatening (<6.5 g/dl) in which mild (38.46%) are said to be more, followed by moderate (31.53%), severe (20.76%), life-threatening (9.23%), respectively.

Table 4 Percentage of patients with a range of haemoglobin (Hb)

Range of haemoglobin	No of patients	Percentage of patients (%)	Percentage of Male (%)	Percentage of Female (%)
Mild (10-14 g/dl)	50	38.46%	35.00%	15.00%
Moderate (8-10 g/dl)	41	31.53%	18.00%	23.00%
Severe (6.5-8 g/dl)	27	20.76%	12.00%	15.00%
Life Threatening (<6.5)	12	9.23%	4.00%	8.00%

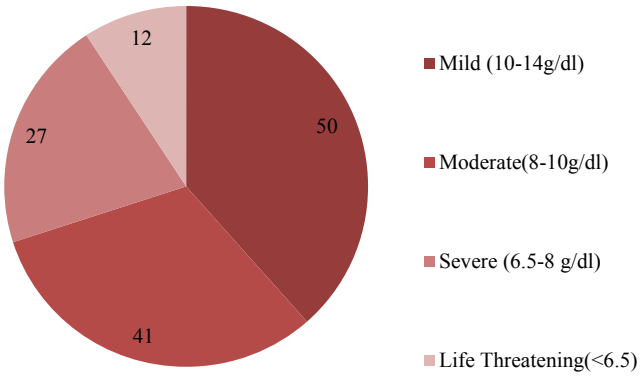

Figure 4 Percentage of patients with a range of haemoglobin (Hb)

In Table 5 and Figure 5 the patients were divided based on their habitats into 2 groups: smoker and alcoholic in which alcoholic (4.61%) is more than smoker (2.3%) group.

Table 5 Percentage of patients with social habits

Habits	No of Patients	Percentage of Patients (%)
Smoker	3	2.30%
Alcoholic	6	4.61%

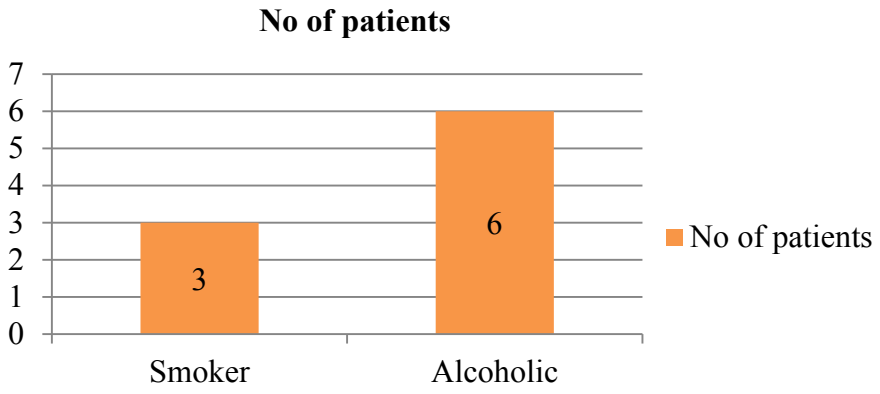

Figure 5 Percentage of patients with social habits

In Table 6 and Figure 6 the no of drugs in the collected prescriptions were divided into 19 categories in which antibiotics (22.35%) are said to be more followed by anti-ulcer (13.64%), anti-hypertensives (9.41%), anti-asthmatics (8.35%), analgesics (5.76%), antipyretics (4.82%), corticosteroids (2.94%) respectively.

Table 6 Percentage of the category of drugs

Category of Drugs	No of Drugs	percentage of Drugs (%)
Anticancer	24	2.82%
Antibiotics	190	22.35%
Anti-ulcer	116	13.64%
Anti-emetics	30	3.52%
Anti-diabetic	32	3.76%
Anti-hypertensive	80	9.41%
Corticosteroids	25	2.94%
Antipyretic	41	4.82%
Anti-asthmatic	71	8.35%
Anti-platelets	37	4.35%
Analgesics, NSAID's	49	5.76%
Statins	12	1.41%
Vitamin supplements	50	5.88%
Iron supplements	20	2.35%
Blood transfusions	62	7.29%
Anti-allergic	3	0.35%
Anti-oxidants	2	0.23%
liver protectants	2	0.23%
Anti-malarial	4	0.47%
Total number of drugs	850	

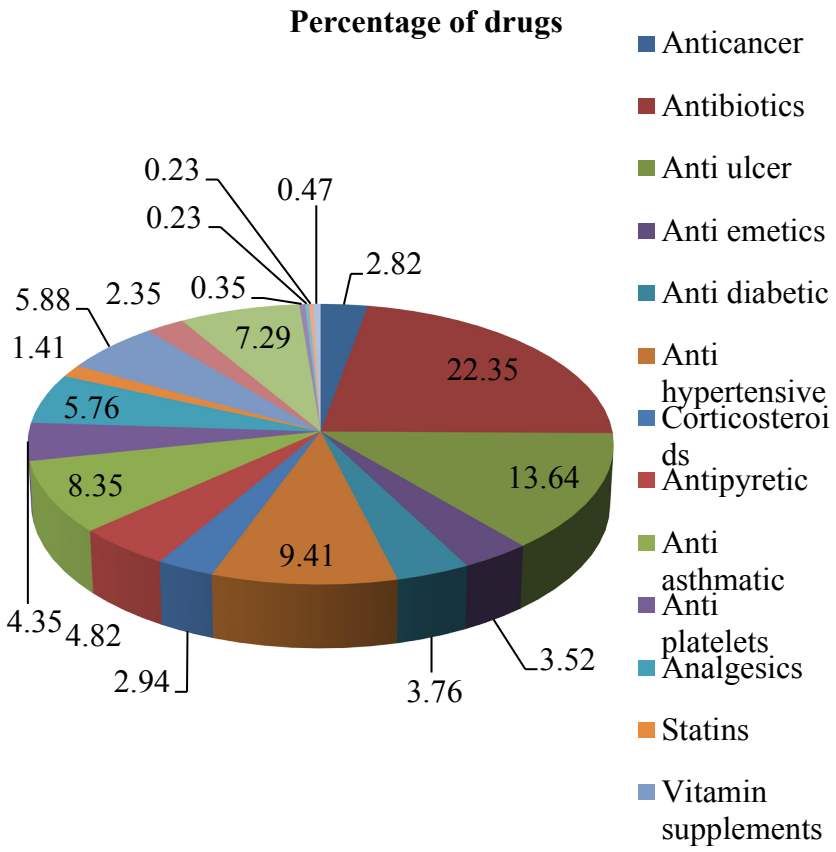

Figure 6 Percentage of the category of drugs

In Table 7, among the 130 cases collected, the daily analysis of haemoglobin was reported only in 39 cases because only in few cases the daily analysis was performed based on the severity of the patient's condition.

Table 7 Day wise analysis of haemoglobin value in collected cases

Range of Haemoglobin						Disease Condition
Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	
9.9	-	-	-	-	-	Pulmonary edema (accelerated HTN)
-	-	13.2	-	12.6	-	Ca nasopharynx
-	-	-	-	-	12.4	Cholilitheasis
12.2	11.4	12.1	-	-	-	GI Bleed
5.2	6.8	7.7	6.3	-	-	Menorrhagea with anaemia
7.2	6.4	8.2	7.2	-	-	Drug overdosing (BZD)
11.1	-	-	-	-	-	Ca right breast
9.2	-	-	-	-	-	CAD, DM, Gangrene
5.8	-	-	-	-	-	CKD on hemodialysis
-	-	-	-	-	6.5	CKD (Stage 5)
5.5	7.4	9.6	8.8	8.7	-	ALD with Portal HTN
-	10.8	-	-	-	-	Acute LV Dysfunction
11.8	13.7	-	-	-	-	Oesophageal stricture
-	-	9.5	10.1	10.1	-	HLH
9.7	9.2	-	-	-	-	UTI Bleed
-	10.0	-	-	-	-	CLD with portal HTN
7.1	-	-	-	-	-	CKD
9.3	10.2	11.4	10.7	-	-	GI Bleed (erosive gastritis)

11.6	10.1	-	-	-	-	Dengue hemorrhagic fever
9.4	8.9	9.9	10.9	-	-	Chronic duodenal ulcer
8.2	-	-	-	-	-	SAIO
10.5	-	-	-	-	-	IDA
15.1	13.8	-	-	-	-	Ulcerative colitis
11.0	9.4	-	-	-	-	Inflammatory colitis
-	9.3	8.3	-	-	-	Anaemia, CAD, Cirrhosis
9.9	11.9	12.3	-	-	-	CLD with portal HTN
6.5	6.2	8.6	8.8	8.2	7.0	CKD (Stage 1), Anaemia
11	-	-	-	-	-	Bronchial asthma
5.5	-	-	-	-	-	SLE
8.5	7.8	-	-	-	-	RTA Head injury
-	7.2	-	-	-	-	CKD (Stage 5)
10.5	-	-	-	-	-	CAD (DVD)
13.6	-	-	-	-	-	CAD
7.4	6.5	-	-	-	-	Acute on CKD
9.1	9	-	-	-	-	Chronic Ostectomy
8.1	7.6	5.8	5.9	5.9	-	UTI, Cholecystitis, Anaemia
12.2	-	-	-	-	-	TB Meningitis
12.9	-	-	-	-	-	Acute gastroenteritis, Cholelithiasis
11.3	-	-	-	-	-	Acute gastroenteritis

DISCUSSION

In our study we have found that the disease conditions like CKD, CLD, CAD, and cancer were found to be more and have a possibility of causing anaemia which was similar to the studies conducted by Babitt, et al., Alexandrakis, et al., [2,3]. Our study has found that the following category of drugs can have the significance of causing anaemia, like antibiotics, NSAID's and analgesics which was similar to the study conducted by Garratty, et al., [5]. According to previous literature women were found to be more anaemic but in our study men were found to more anaemic in mild cases (10-14 g/dl) which was supported by the study conducted by Lee, et al., and Kucera, et al., [6,7].

CONCLUSION

The study provides an overview of the prescription analysis of anaemic condition with pharmacist intervention in tertiary care hospital. Patients became more anaemic during the hospital stay from the time of admission. The observed disease conditions and the drugs may also show significance in the occurrence of anaemia and in most of the prescriptions appropriate treatment for anaemia was not provided during the hospital stay which includes our intervention regarding the study. Our results imply that initially patients were found to be anaemic at the time of admission but the anaemic condition is not treated and according to prescription analysis we found that they became more anaemic during the treatment process which may be due to their pathological condition such as Chronic kidney disease (CKD), Coronary artery disease (CAD), cancer, Chronic liver disease (CLD) or due to the usage of prescribed drugs like antibiotics, analgesics, NSAID's observed in the study. As per the literature females were prone to be anaemic, surprisingly in our hospital study we have found that males were found to be anaemic in the age group of 25-64 years in mild anaemic category (10-14 g/dl), whereas in the moderate (8-10 g/dl), severe (6.5-8 g/dl) and life-threatening (>6.5 g/dl) female cases were more.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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