International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: SJIF: 5.995
Available Online at www.journalijcar.org
Volume 6; Issue 11; November 2017; Page No. 7515-7520
DOI: http://dx.doi.org/10.24327/ijcar.2017.7520.1168

Research Article

ADVERSE EVENT MONITORING IN PATIENTS ON NEWER ANTI-DIABETIC DRUGS OF A TERTIARY CARE HOSPITAL IN NORTH INDIA

Jatinder Singh[1]., Shalini Arora[2]., Bharti Mahajan[3]., Naveen Mittal[4]., Sandeep Kaushal[5]., Robinson Gill[6] and Manhardeep Kaur*[7]

[1,2,3,5]Department of Pharmacology, Dayanand Medical College, Ludhiana
[4]Endocrinology Department, Dayanand Medical College, Ludhiana
[6]Fortis Hospital, Mohali
[7]Department of Community Medicine, Rajindra Medical College, Patiala

ARTICLE INFO

Article History:
Received 18th August, 2017
Received in revised form 10th September, 2017
Accepted 06th October, 2017
Published online 28th November, 2017

Key words:
Adverse drug reaction, Adverse event, Newer anti-diabetic drugs

ABSTRACT

Background- Adverse event is any untoward medical occurrence that may present during treatment with a pharmaceutical product but which does not necessarily have a causal relationship with this treatment. The adverse event is called Adverse drug reaction (ADRs) when causality relationship is established with the drug. Prescription event monitoring is a method to know utilization and ADRs of drug. It is important method as the drug under study is consumed by large number of patients and multiple doses, for more than one indication and for longer duration. Despite all efforts, ADR monitoring and reporting activity is stillpoor in India.

Objective- To determine frequency and distribution of adverse drug events in patients on newer anti-diabetic drug therapy.

Material and Methods- This cross sectional observational study was carried out on patients presenting in Endocrinology OPD of a tertiary care hospital in North India for a duration of one and half year i.e. from January, 2014 to June, 2015. Data regarding the patient demographics and ADRs was collected by patient interviews.Causality was assessed by WHO causality assessment scale and Naranjo scale.

Results-A total of 146 ADRs were reported during this duration in 118 patients (58 males, 61 females). Mean age of patients was 54.10 ±9.91 years (Males:51.6 ±9.89 years, Females:56.8 ±10.72 years). The number of ADRs per patient was 1.25. The most common drug leading to ADR was Sitagliptin (35.62%) followed by Glimepiride (34.02%) and Pioglitazone (22.52%) The most common ADR noted was weakness/ fatigue (20.00%) followed by nausea (14.17%) and hypoglycaemia (10.28 %).

Conclusions- The newer anti diabetic drugs cannot be considered as absolutely safe, although the nature of ADRs with these drugs is mild to moderate. We need to monitor these drugs for a longer duration of time and in larger number of patients to be sure of safety profile.

INTRODUCTION

Adverse event is defined as any untoward medical occurrence that may present during treatment with a pharmaceutical product but which does not necessarily have a causal relationship with treatment. When a causal relationship is established between drug and adverse event, it becomes adverse drug reaction (ADR) or adverse drug effect. ADRs are a major problem worldwide. Even in developed countries like US, where drugs are used cautiously, ADRs are 4th-6th leading cause of death and account for 6.7% of hospitalized patients. In India, due to malpractice by unqualified practitioners and unsupervised usage of drugs, ADR incidence is likely to be high and constitute an enormous burden for society.[1] As ADRs result in significant morbidity, extended hospital stay, increased health expenditure and mortality, so drugs must be prescribed rationally and constant monitoring of ADRs is mandatory.

Every medicine is tested on a relatively small proportion of the population, in highly selected patients in pre-marketing trials excluding pregnant, lactating women and patients of extreme age groups, those with complicated medical history and on multiple drug therapy for only brief period. Therefore, adverse reactions having frequency less than 0.5 to 1% are missed and adverse reactions that appear within the finite duration of trial are reported. Delayed reactions and ADRs occurring with

*Corresponding author: **Manhardeep Kaur**
Department of Community Medicine, Rajindra Medical College, Patiala

chronic use are missed in pre marketing trials. As the drug is marketed, it is administered to several thousand patients with multiple medical problems and on multiple drug therapies in different age groups. Therefore, ADR monitoring should be started along with administration of drug and continued throughout life of the drug.[2]

After the Thalidomide disaster of 1962, Pharmacovigilance programs were set up in many countries like UK, Australia, New Zealand, Canada and Sweden in 1964-65.[3]Central Drugs Standard Control Organization (CDSCO) has initiated a well structured and highly participative Pharmacovigilance Programme of India (PvPI). In spite of all factors, pharmacovigilance has not picked up well in India and the reporting is still poor. India rates below 1% in pharmacovigilance as against the world rate of 5%[4]

Diabetes mellitus is a common metabolic disorder worldwide as well as in Indian population. In 2000, India (31.7 million) became diabetic capital of the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively.[5]

Pharmacological treatment remains the main option for most of these patients. The conventional treatment options include biguanides, sulfonylureas, and meglitinides. Despite efficacy of these drugs, there are some safety issues with conventional antidiabetic drugs. Therefore, the medications must be individualized for each patient by balancing benefit and anticipated specific safety issues, as well as other characteristics of regimens, including ease of use, long-term adherence, expense and the nonglycemic effects of the medications. Therefore, apart from large number of conventional anti-diabetic drugs are in use, a number of newer anti diabetic has been introduced in the last two decades. It becomes all the more important to monitor the short term and long term safety of anti-diabetic drugs. The drug safety data on newer antidiabetics is lacking in our population. This study is planned to monitor the adverse events in the patients of Diabetes Mellitus on newer Anti-diabetic drugs including Glimepiride, Sitagliptin, Vildagliptin, Saxagliptin, pioglitazone, Glulisine, canagliflozin,

Dapaglifozin, Voglibose, Acarbose, Colesevelam, Lispro, Aspart, Detemir, Exanatide, Liraglutide, and Glargine and data collected will be reported to PvPI.

MATERIAL AND METHODS

Source of Data

This cross sectional study was conducted in the outpatient department of Endocrinology in a Medical College and Hospital of North India for a period of one and a half year (1/1/2014 to 31/6/2015) after taking clearance from the institutional ethical committee. A written informed consent was taken from the patients for participation in the study after screening for adverse event on newer antidiabetic drug. The drugs which are relatively new and have been in the market for around 15 years were taken as newerdrugs. Newer Anti-diabetic drugs include Glimepiride, Sitagliptin, Vildagliptin, Saxagliptin, pioglitazone, Glulisine, canagliflozin, Dapaglifozin, Voglibose, Acarbose, Colesevelam, Lispro, Aspart, Detemir, Exanatide, Liraglutide, and Glargine. All patients on newer anti-diabetic drugs were interviewed and their data was recorded in the performa. Patient of any age and gender having adverse event on newer anti-diabetic drug was included in the study. All reactions were reviewed and causality assessment was done according to the WHO UMC causality assessment scale and Naranjo scale to label adverse event as adverse drug reaction. History of the disease along with the drug history, duration of drug intake and ADR associated with drug therapy was recorded. The proforma filled for the adverse events experienced by the patients for ADR monitoring was designed on the basis of WHO guidelines and the form also included details like age, gender, demographic details, past medical history, present drug treatment, description of adverse event, its assessment and treatment for the drug reaction. Regular follow up of the patient was done for a minimum of seven days to a maximum of 14 days to assess the response of treatment. The scoring of adverse events was done according to Naranjo algorithm and WHO UMC Casualty assessment scale. No re-challenge with the drug was performed to confirm the relationship.

Statistical analysis: The data collected was recorded in a proforma and was analysed using descriptive statistics.

All data of ADRs of newer Anti-diabetic drugs was reported to PvPI in Vigibase through vigiflow software in regional ADR monitoring center.

Observations

The number of prescriptions of diabetic patients screened over a period of one and a half year were 2085, these included 317 patients on newer anti diabetic drugs among which 118 patients suffered from 146 adverse drug events.

The most commonly used drug was Glimepiride in 144 (45%), followed by Dipeptidyl peptidase 4(DPP-4) inhibitors in 90 (28%) patients, pioglitazone in 60 (19%), alpha glucosidaseinhibtors in 18 (6%), and GLP 1 analogue in 3 (1%) patients, insulin glargine in 2 (0.67%) patients.

Frequency of ADRs per patient was 1.24. The most common drugs leading to were DPP-4 inhibitors (Sitagliptin and Vildagliptin) followed by Glimepiride, glitazones, alpha glucosidase inhibitors,GLP-1 analogues and insulin as shown in Fig.1

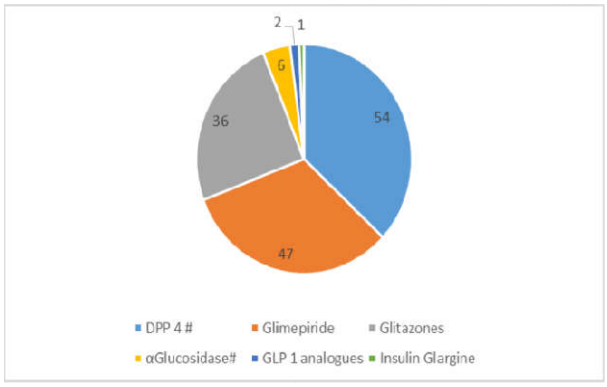

Fig 1 Distribution of newer anti-diabetic drugs causing adverse events

Out of 146 adverse drug reactions, 54 (36.2%) were due to Dipeptidyl peptidase 4 inhibitors, Glimepiride (sulphonylureas) was causal in causing 47 (34.02%) while thiazolidinedione (Pioglitazone) group caused 36 (22.52%) adverse reactions. Voglibose (Alpha glucosidase inhibitor) was responsible for 6 (4%) adverse reactions. Liraglutide (Glucagon like peptide-1 analogue) caused 2(1.32%) and Insulin Glargine caused 1 (0.67%) adverse reaction.

Incidence of ADRs was maximum with GLP 1 analogues, followed by DPP 4 inhibitors and Glitazones, followed by Insulin Glargine and least with Glimepiride as Table 1.

Table 1 Incidence of ADRs

Anti diabetic drug group	Number of prescriptions	Number of events
GLP1 analogue	3	2
DPP 4 inhibtors	90	54
Glitazone	60	36
Insulin Glargine	2	1
Glimepiride	144	47

The most common ADRs reported are shown in Fig 2. These were weakness/ fatigue seen in 29 (19.46%) patients followed by nausea in 21 (14.09%) ; hypoglycemia and rash each in 14 (9.39%).; pedal edema in 13 (8.7%); headache in 12 (8.05%); diarrhoea in 9 (6.04%); body aches in 8 (5.36%); constipation in 7 (4.69%); bloating of abdomen, vomiting & shortness of breath each in 4 (2.68%); increased hunger & dizziness each in 2 (1.34%); weight gain, allergic reaction & itching each in 1 (0.06%).(Fig. 2).

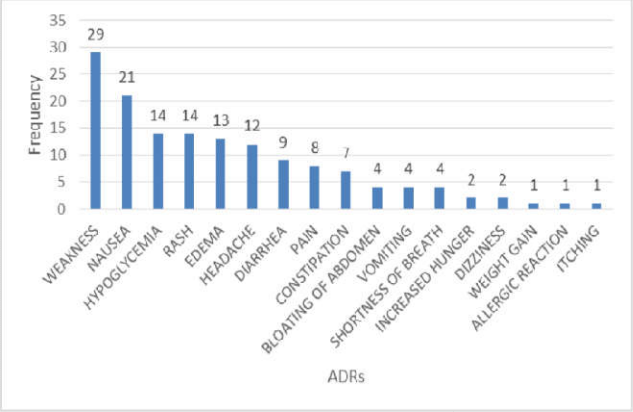

Figure 2 Spectrum of ADRs with Newer Anti diabetic agents

A total of 146 ADRs were reported which are shown in Table 2 along with the drugs causing them.

Table 2 ADRS along with the drugs causing them

ADRs	Drugs	Number of Patients	Number of Events (%)
Weakness/ fatigue	Pioglitazone	60	17(28.3%)
Nausea	Sitagliptin	80	7(8.75%)
Hypoglycemia	Sitagliptin	80	4(5%)
Rash	Sitagliptin	80	7(8.7%)
Pedal edema	Pioglitazone	60	5(8.34%)
Headache	Sitagliptin	80	9(11.2%)
Diarrhoea	Sitagliptin	80	4(2.7%)
Body aches	Glimepiride	144	2(1.33%)
Constipation	Voglibose	18	2(11.1%)
Abdominal Bloating	Pioglitazone	60	1(1.67%)
Vomiting	Glimepiride	144	3(2.01%)
Shortness of breath	Glimepiride	144	3(2.01%)
Polyphagia	Pioglitazone	60	1(0.67%)
Dizziness	Sitagliptin	80	1(1.27%)
Weight gain	Glimepiride	144	1(0.67%)
Allergic reactions	Sitagliptin	80	1(1.27%)
Itching	Glimepiride	144	1(0.67%)

A difference in adverse drug reactions according to age was also seen. Maximum number of cases (40%) were in the age group of 51-60 years and least in the extremes of age.There were 2 ADRs in 20-30 years age group, 6 in 30-40 years, 25 in 40-50 years, 34 in 60-70 years and 5 in 70-80 years age group(Fig.3). Mean age of patients was 54.10 ±9.91 years (Males: 51.6 ±9.89 years, Females: 56.8 ±10.72 years) (Table 3).

Table 3 Gender Distribution of ADRS

	Males	Females
No of Patients enrolled(%)	57(48.30)	61(51.69)
Mean Age ±Standard deviation (Years)	51.6 ±9.89	56.8 ±10.72

The adverse drug reactions were reported more in females i.e. 61(51.69%) as compared to the males-i.e. 57(48.30%) as shown in Table 3.

Demographic profile

There was difference in adverse drug reactions according to demographic profile. Urban patients constituted 92 (77.31%) of adverse drug reactions and rural patients constituted 26(22.69%).(Table 4).

Table 4 ADRs according to demographic profile

	Urban (%)	Rural (%)
Number of patients on newer antidiabetic drugs	215(67.8%)	102(32.1%)
Patients with ADRs on newer antidiabetic drugs	92 (77.9%)	26(22%)

ADRs according to number of drugs prescribed

9 (6%) adverse drug reactions were present in patients on monotherapy with newer anti diabetic agents while 54 (41%) adverse drug reactions were due to dual drug therapy with anti diabetic drugs, 65 (44%) adverse drug reactions were caused by triple drug therapy and number of adverse drug reactions due to combination of four drugs were 18 (12%). (Fig.4)

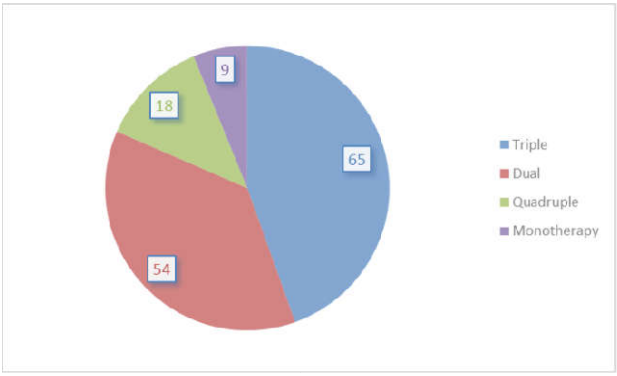

Figure 4 Distribution of ADRs depending upon number of drugs used

Causality assessment

A causal relationship between the drug and the reaction was assessed depending upon the lag period between the start of the drug and appearance of the reaction, response to de-challenge, laboratory tests and the data available regarding the drug using the WHO UMC causality assessment scale and Naranjo scale. Dechallenge (discontinuation of the suspected drug) was done in 41% cases, whereas in 59% of the cases initial drug therapy was continued. Causality assessment was done according to WHO UMC causality assessment scale and Naranjo scale as shown in figure 5 & 6 respectively.

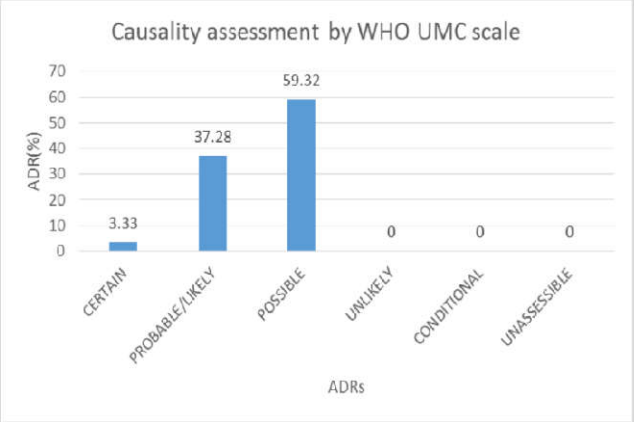

Figure 5 Causality assessment by WHO UMC scale

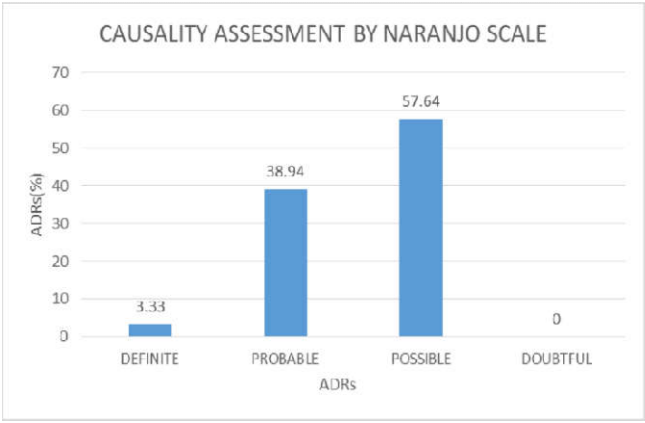

Figure 6 Causality assessment by Naranjo scale

DISCUSSION

A wide range of adverse drug reactions are caused by newer anti diabetic drugs. The present study was conducted in patients attending the Endocrinology OPD of a Medical College and Hospital Medical College and Hospital of North India. The ADRs reported with newer antidiabetic drugs were recorded over a period of one and a half year. The frequency and distribution of adverse drug reactions and the newer anti diabetic drugs implicated in these reactions were studied.

The most frequent adverse drug reactions in our study were weakness/ fatigue seen in 29 patients (19.46%) followed by nausea in 21 (14.09%); hypoglycemia and rash each in 14 (9.39%); pedal edema in 13 (8.7%); headache in 12 (8.05%); diarrhoea in 9 (6.04%); body aches in 8 (5.36%); constipation in 7(4.69%); abdominal bloating, vomiting & shortness of breath each in 4 (2.68%); increased hunger & dizziness each in 2 (1.34%); weight gain, allergic reaction & itching each in 1 (0.06%) patient.

Similar pattern of adverse reactions were observed in different studies. Sharma H (2004) *et al* in a four months study in Hamdard university teaching hospital, New Delhi found hypoglycemia caused by glibenclamide as most commonly reported ADR. [6] In our study, hypoglycemia was most commonly caused by glimepiride in 5 (3.13%) patients, sitagliptin in 4 (2.68%), pioglitazone and Voglibose in 2 (1.34%) patients each and by glargine in 1 (.67%) patients.

Similarly, Kumar PU *et al* (2009) in a 1 year study in patients admitted to all medical wards in Kasturba Medical College and Hospital, Attavar, Mangalore found hypoglycemia in 2 patients due to sulfonylureas contributing 0.8% to the total patient population with ADRs.[7]

Palanisamy S *et al* (2009) in a 6 months study in superspeciality hospital in India identified hypoglycemia in 3(5%) patients with glipizide and nausea in 2 (3.33%) patients with gliclazide and metformin as reported ADRs.[8] In our study, nausea was most commonly associated with Glimepiride in 12 (8%) patients, sitagliptin in 7 (3.69%) and pioglitazone in 2 (1.32%) patients.

The reason for this variation can be explained on the basis of different ethnic group characteristics, coexisting diseases and hence different drug prescription patterns.

According to most of the studies done on adverse drug reactions; hypoglycemia, nausea and pedal edema have been the most frequent adverse reactions while in our study most frequent adverse drug reaction was weakness / fatigue followed by nausea and hypoglycemia.[6-8] There may be an overlap between symptoms of the disease as such and the ADRs caused by the antidiabetic agents. For example, weakness and fatigue can be explained as a part of disease as well as an ADR. Most of these studies were based on spontaneous reporting of the adverse drug reactions occurring from the drugs prescribed to the patients while our study was based on intensive ADR monitoring with newer anti diabetic agents [6-8].

Drug prescription in a diabetic patient depends upon patient's profile, availability, cost and safety profile of drug. The most common drugs in our study leading to adverse drug reactions were Dipeptidyl peptidase 4 inhibitors 54 (36.2%) followed by Glimepiride 47 (34.02%), thiazolidinediones 36 (22.52%), alpha glucosidase inhibitors 6 (4%),GLP-1 analogues 2 (1.27%) and insulin Glargine 1 (0.67%).

In our study most of the adverse drug reactions were found to be caused by Dipeptidyl peptidase inhibitors which were mild in nature. Since DPP 4 inhibitors are newer drugs in the market, much data on the ADR reporting of this group of drugs is not available. So this may also contribute to the difference in pattern of the results seen in other studies and in our study.

A difference in adverse drug reactions according to age was also seen. Maximum number of cases i.e. 87 (73.7%) were in the age group greater than 50 years and least in the extremes of age. There were 2 ADRs in 20-30 years age group, 6 in 30-40 years and 25 in 40-50 years. Mean age of patients was 54.10 ±9.91 years (Males: 51.6 ±9.89 years, Females: 56.8 ±10.72 years).

Machado-Alba *et al*.(2015) carried out a study to collect information about all rheumatoid arthritis patients at an IPS-E between 1 December 2009 and 30 August 2013. Reported patients were with a mean age of 52.7 years (± 13.1) (range: 3–90; median: 53). Only six patients were under 18 years of age. Results obtained are similar to our study as mean age was 54.10±9.91 years [9]

Vijayakumar TM *et al* (2013) in a study carried out over a period of eight months in KIMS Teaching Hospital, Amalapuram, Andhra Pradesh reported that adult patients were affected the most. Patients above 60 years of age experienced 97(53%) of the ADRs, followed by 19_40 year olds i.e. 64(34%) and paediatrics patients i.e. 22(13%). [10]

Richa, *et al*.(2013) in an observational cross-sectional analysis carried out in a tertiary care teaching hospital from north India from November 2010 to November 2013 reported that adult population accounted for 63.1%, followed by geriatric (20.4%) and paediatric population (16.5%) of the total ADRs. [11]

In our study, the adverse drug reactions were reported more in females i.e. 61 (51.69%) as compared to the males i.e. 57 (48.30%). Gallo M *et al*. (2012) in a 6-month study carried out on the paediatric wards of five hospitals in a close area of the Campania Region reported four out of six ADRs occurred in female patients.[12]. A study conducted by Knopf H *et al* (2006) in Robert Koch Institute has also reported girls with a higher proportion of ADRs than boys ($P < 0.05$)[13]

Results obtained in our study were similar to above discussed studies, as women are more likely to suffer from adverse drug reactions. It may be because of excess drug dose on average per kilogram body weight as most dose calculations are based on body weight of person [14]

While in some studies like Thalla S et.al (2013) has reported males representing 68.69% of the cases. [15] Also, Shareef SM *et al* (2014) in a study over a period of 1 year has shown male to female ratio as 1.13:1.[16] Although there are few studies reporting more ADRs in males but as in our study, most of the studies have reported ADRs to be more in females as compared to males.

In our study, 8 (6%) adverse drug reactions were present in patients on monotherapy with newer anti diabetic agents while 54 (41%) adverse drug reactions were due to dual drug therapy with antidiabetic drugs, 59 (45%) adverse drug reactions were caused by triple drug therapy and number of adverse drug reactions due to combination of four drugs were 11 (8%). Similarly, Harmark L *et al* (2012) found that use of multiple drugs is associated with higher incidence of drug reactions as increased frequency is seen in hospitalized patients. [17] Sharma H *et al* (2004) reported polypharmacy had a major influence on the occurrence of ADRs with a total of 71 (58.0%) ADRs observed in patients receiving 4 or more medications concurrently. Conversely, 46 (37.7%) ADRs were detected in patients on 3 or less medicines.[6] Vora MB.*et al* (2015) reported that 26(3.13%) patients suffered ADRs who received upto 3-5 number of drugs and 16 (1.93%) patients with ADRs received 2 drugs. [18]

As any other study, our study too has few limitations. We studied only the patients attending endocrinology OPD. We could have included all diabetic patients from other OPDs and indoor also. As we have restricted ourselves to endocrinology OPD, some drug groups like DPP 4 inhibitors, GLP 1 analogues were prescribed less and hence conclusion may not be generalized. We, however, feel that the duration of the study and sample size was adequate for the given period of study as it was able to cover all the seasons in a year.

SUMMARY AND CONCLUSIONS

ADR monitoring of drugs is important as it clarifies the safety of available drugs. ADR monitoring and reporting activity is still in establishment phase in India.

The present study was conducted with an aim to determine frequency and distribution of adverse drug events in patients on newer anti-diabetic drug therapy in cross sectional observational study on patients attending Endocrinology OPD of a Tertiary care hospital in North India for a duration of one and a half year. Data regarding the patient demographics and ADRs was collected by patient interviews and entered in individual proforma. Causality was assessed by both WHO causality assessment scale and Naranjo scale.

A total of 146 ADRs were reported during this duration in 118 patients (58 males, 61 females). Mean age of patients was 54.10 ± 9.91 years (Males: 51.6 ±9.89 years, Females: 56.8 ±10.72 years). Number of ADRs were 1.24 per patient.

The most common drug leading to ADRs was Sitagliptin (35.62%) which was responsible for 50 ADRs in 80 patients, followed by Glimepiride (34.02%) which caused 47 ADRs in 144 patients and Pioglitazone (22.52%) leading to 36 ADRs in 60 patients, patients. The ADR noted most commonly was weakness/ fatigue (20.00%) followed by nausea (14.17%), hypoglycemia and rash each in 14 (9.39%); pedal edema in 13 (8.7%); headache in 12 (8.05%); diarrhoea in 9 (6.04%); body aches in 8 (5.36%); constipation in 7(4.69%); abdominal bloating, vomiting & shortness of breath each in 4 (2.68%); increased hunger & dizziness each in 2 (1.34%); weight gain, allergic reaction & itching each in 1 (0.06%) patient.

The adverse drug reactions were reported more in females i.e. 61(51.69%) as compared to the males i.e. 57(48.30%). As far as frequency of ADRs was considered according to the number of drugs administered in a patient, 8 (6%) adverse drug reactions were present in patients on monotherapy while 54 (41%) adverse drug reactions were due to dual drug therapy, 59 (45%) were caused by triple drug therapy and number of adverse drug reactions due to combination of four drugs were 11 (8%). The number of ADRs increased with increase in number of antidiabetic agents. However ADRs were less in quadruple drug regime as number of patients taking quadruple drug regime were less.

A difference in adverse drug reactions according to age was also seen. Maximum number of cases (40%) were in the age group of 51-60 years and least in the extremes of age.

It can be concluded that newer anti diabetic drugs are not entirely safe and there is an urgent need for monitoring these drugs. This can be done by post marketing surveillance at large number of centers over a long period of time.

However these results need to be verified in multi-centric studies as sample size for some of them were small and hence cannot be extrapolated to large population. Since all the adverse effects of the drugs cannot be prevented, it is necessary to evaluate patterns of adverse reactions and the common drugs implicated in these reactions.

Physicians should be aware of these ADRs so that these can be taken care of at an early stage. This will enhance the safety of newer antidiabetic drugs.

Compliance with Ethical Standards:

Funding: No source of funding.

Conflict of Interest: None

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

References

1. Srinivasan R, Ramya G. Adverse drug reaction-causality assessment. *IJRPC*. 2011, 1(3):606-13.
2. Dhikav V, Singh S, Anand KS. Adverse Drug Reaction Monitoring In India. *JIACM*. 2004; 5(1):27-33.
3. Ahmad SR. Adverse event monitoring at food and drug administration. *J Gen Intern Med*. 2003; 18:57-60.
4. Ghosh AK, Bala NN, De A. Current problems and future aspects of pharmacovigilance in India. *International Journal of Pharma and Bio Sciences*. 2011;2(1):14-28.
5. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. *The Australasian Medical Journal.* 2014;7(1):45-48. doi:10.4066/AMJ.2013.1979.
6. Sharma H, Aqil M, Imam F, Alam MS, Kapur P, Pillai KK. A pharmacovigilance study in the department of medicine of a university teaching hospital. *Pharmacy Practice.* 2007;5(1):46-9.
7. Kumar PU, Adhikari P, Periera P. A Prospective Analysis of Adverse Drug Reactions in a South Indian Hospital. *Online J Health Allied Scs*. 2009;8(3):1-6.
8. Palanisamy S, Kumaran KSA, Rajeskaran A. A Study on assessment, monitoring and reporting of adverse drug reactions in Indian Hospital. *Asian j Pharm clin Res.* 2011;4(3):112-6.
9. Machado-Alba JE, Ruiz AF, Machado-Duque ME. Adverse drug reactions associated with the use of disease-modifying anti-rheumatic drugs in patients with rheumatoid arthritis. *Rev Panam Salud Publica*. 2014;36(6):396-401.
10. Vijayakumar TM, Dhanaraju MD. Description of Adverse Drug Reactions in a Multi-specialty Teaching Hospital. *Int. j. integr. med*. 2013;1(26):1-6.
11. Richa, Tandon VR, Sharma S, Khajuria V, Mahajan V, Gillani Z. Adverse drug reactions profile of antimicrobials: A 3-year experience, from a tertiary care teaching hospital of India. *Indian J Med Microbiol* .2015; 33:393-400.
12. Gallo M, Clavenna A, Bonati M, Siani P, Irpino A, Rossi F. Active surveillance of adverse drug reactions in children in five Italian paediatric wards. *Open Journal of Pediatrics*.2012; 2:111-7.
13. Knopf H, Du Y. Perceived adverse drug reactions among non-institutionalized children and adolescents in Germany. *British Journal of Clinical Pharmacology*. 2010; 70 (3): 409-17.
14. Davies EC, Green CF, Taylor S, Williamson PR, Mottram DR, Pirmohamed M, *et al*. Adverse Drug Reactions in Hospital In-Patients: A Prospective Analysis of 3695 Patient-Episodes. PLoS ONE. 2009; 4(2):1-7. doi:10.1371/journal.pone.0004439
15. Thalla S, Ramana KV, Sheherbanu S, Ashya S, Reddy MA, Lakshmi B. ADR monitoring in hypertension outpatient department of hospital. *Indian Journal of Research in Pharmacy and Biotechnology*. 2013;1(2):188-90.
16. Shareef SM, Naidu CDM, Raikar SR, Rao YV, Devika U. Development, implementation and analysis of adverse drug reaction monitoring system in a rural tertiary care teaching hospital in Narketpally, Telangana. *Int J Basic Clin Pharmacol*.2015; 4:757-60.
17. Härmark L, Alberts S, Puijenbroek EV, Denig P, Grootheest PV. Representativeness of diabetes patients participating in a web-based adverse drug reaction monitoring system. *Pharmacoepidemiology and Drug Safety*. 2012; 22(3):1-7.
18. Vora MB, Trivedi HR, Shah BK, Tripathi BC. Adverse drug reactions in inpatients of internal medicine wards at a tertiary care hospital: A prospective cohort study. *Journal of Pharmacology and Pharmacotherapeutics*. 2011;2(1):21-6.

How to cite this article:

Jatinder Singh *et al* (2017) 'Adverse Event Monitoring in Patients on Newer Anti-Diabetic Drugs of a Tertiary Care Hospital in North India ', *International Journal of Current Advanced Research,* 06(11), pp. 7515-7520.
DOI: http://dx.doi.org/10.24327/ijcar.2017.7520.1168

****