International Journal of Research in Medical Sciences
Samal R et al. Int J Res Med Sci. 2017 Jul;5(7):2931-2937
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20172537

Original Research Article

Study of utilization pattern and analysis of efficacy of newer angiotensin receptor blockers in patients with hypertension and type-II diabetes with or without hypertension

Rajashree Samal*, Jyoti Prakash Panda, Kali Prasad Pattnaik

Department of Pharmacology, SCB Medical College, Cuttack - 753007, Odisha, India

Received: 15 May 2017
Revised: 18 May 2017
Accepted: 19 May 2017

***Correspondence:**
Dr. Rajashree Samal,
E-mail: amritrajashree@yahoo.com

ABSTRACT

Background: Interventions that target blood pressure control and proteinuria, specifically interruption of the Renin-angiotensin-aldosterone system (RAAS), have been utilized in attenuating cardiovascular complications. Angiotensin receptor blockers (ARBs) have been reported to have certain advantages. The objective of the study was to evaluate and compare the utilization pattern and efficacy of different ARBs in patients with HTN and associated type-II diabetes.
Methods: Hypertensive patients with or without type-II diabetes treated with ARB based regimen were selected. The BP and 24 hours urinary albumin excretion were analysed at baseline and after three months of treatment.
Results: Mean reduction in systolic blood pressure(SBP) was more with ARBs and calcium channel blocker(CCB) combination. Telmisartan alone and with ACEI reduced diastolic blood pressure (DBP) maximally in diabetic hypertensive patients. Proteinuria was significantly reduced with telmisartan ($p<0.001$) and olmesartan ($p<0.05$) based therapy. The side effects were minimal with ARB based therapy. Telmisartan was the costliest among all ARBs
Conclusions: There was suboptimal use of combination therapy in diabetic hypertensive patients. Telmisartan was having the better control on 24hr urinary albumin excretion.

Keywords: Angiotensin receptor blockers, AT1 receptor, Hypertension, Type-II diabetes mellitus

INTRODUCTION

Hypertension (HTN) is a major cause of morbidity, mortality and an important public health challenge worldwide. It is second only to diabetes as the leading independent cause of end stage renal disease (ESRD), the risk of which increases continuously with the extent and duration of elevated blood pressure (BP).[1-5] Diabetes mellitus is the major metabolic disease of modern times and responsible for majority of morbidity and mortality worldwide.[6] The major adverse outcomes of diabetes mellitus are a result of macro and microvascular complications.[7,8] The vascular complications are augmented by the co-existence of HTN.[9] Serious cardiovascular events are more than twice as likely in patients with diabetes and hypertension as with either disease alone.[10] Recent data support that proteinuria is a surrogate marker for cardiovascular risk and reductions in proteinuria correlate with decline in cardiovascular morbidity and mortality. The positive impact of anti-hypertensive therapy on overall cardiovascular event risk reduction is well documented.[11,12] Interventions that target blood pressure control and proteinuria, specifically interruption of the renin-angiotensin-aldosterone system

(RAAS) with either angiotensin converting enzyme inhibitors (ACEI) or ARBs, have been utilized in attenuating the progression of diabetic kidney disease.[13] American Diabetes Association (ADA) and Joint National Committee (JNC-VII) advocate the use of ARBs for management of patients with HTN and diabetes, even in those with advanced stages of nephropathy as well in those with micro-albuminuria.[14,15]

Newer ARBs like telmisartan and olmesartan have stronger affinity for AT_1 receptor and have other added advantages. Telmisartan has been reported to have a greater lipophilicity, longer half-life and the most consistent reduction in blood pressure and hypothesized to have a greater anti-proteinuric effect when compared to the shorter acting losartan. Further, the authors proposed that superiority of telmisartan could be due to its intrinsic peroxisome proliferator-activated receptor gamma (PPAR-γ) agonistic properties. Therefore, this study was undertaken to evaluate whether the above mentioned theoretical benefits actually translate into clinically observable benefits in patients of hypertension as such and associated type-II diabetes.

The choice of drugs for treatment of HTN as such or with other co-morbidities changes at short interval. Efficacy, side effects, both short term and long-term effects on other systems and cost are some of the factors responsible for the change. The evidence base for the cardio-protective potentials of the ARBs includes a number of studies conducted on patients at relatively high risk. ARBs also appear to benefit patients with diabetic nephropathy as demonstrated by several studies.[17] Among available ARBs, the newer ones like olmesartan and telmisartan are reported to have other added advantages over the Losartan. Studies comparing effectiveness of ARBs with each other and another drug class are rare. Studies of utilization pattern of different areas may be valuable in the evaluation of drug effectiveness in common practice.

Therefore, the primary objectives of this study were to evaluate and compare the pattern of use of different ARBs in patients with hypertension as such and patients of type-II Diabetes with or without hypertension and to assess BP control among those patients. And to assess the improvement in renal function and glycemic control in patients of type-II diabetes with or without hypertension.

METHODS

This was an observational study conducted in the Department of Pharmacology in collaboration with the Department of Cardiology and Department of Endocrinology, S.C.B M.C.H, Cuttack.

Participants and data collection

Data were collected for the period of three months from 15.05.2010 to 15.08.2010. All out patients suffering from HTN with or without type-II diabetes on ARB based therapy were screened and selected as per the inclusion and exclusion criteria. We used the medical records of the patients to obtain diagnostic information, laboratory test results, vital signs and prescription drug use. All aspects of the study protocol, including access to and use of the patient clinical information, were authorized by the Institutional Ethics Committee. All diabetic patients with or without hypertension and hypertensive patients as such, seen during the study period were investigated. Elevated or non-target BP was defined as ≥130/80 mm /Hg for diabetes patients with hypertension and 140/90 mm/ Hg for hypertensive patients, according to the JNC 7th report.[16] We classified our study population into two different categories. Patients of only HTN were included under category-1 and type-II diabetes patients with hypertension were taken under category-II. The pattern of use of ARB based therapy was tabulated in both categories of patients and was compared.

Inclusion criteria

- Patients with any stage of hypertension visiting the cardiology and endocrinology OPD and taking ARB based treatment
- Type-II diabetes patients with hypertension
- Patients with type-II diabetes without hypertension.

Exclusion criteria

- Patients with pregnancy and lactation
- Patients with serious end stage renal disease (GFR<15ml/min)
- Patients with any record of diagnosis of chronic heart failure.

Outcome measure

The demographic and the drug treatment information was collected from the patients after taking the consent and noted on the case study form. The Blood pressure (BP) at base line and during follow up was measured carefully by a trained person with an appropriate sized cuff in right arm with the patient seated and 15 min. of rest.

Biochemical profiles of patients of either category were noted from their investigation reports. The individual values at base line and after treatment was tabulated and compared.

The fasting blood sugar, Serum creatinine, albumin excretion rate of each patient was noted and other relevant information was collected.

Statistical analysis

Data were expressed as frequency and as mean ± S.D. Qualitative data were analyzed as percentage value. Paired t-test was used to test for significance between continuous variables. One way Anova followed by Post

Hoc test was done to analyse the significant difference between the groups. P<0.05 was considered as statistically significant and p<0.001 was taken as highly significant.

RESULTS

During our study period, consecutive patients of either sex in the age group of 40-89 years, suffering from hypertension and type-II diabetes with or without hypertension and treated with ARBs (Angiotensin receptor blockers) based therapy were identified. Total 150 patients who met the inclusion criteria were included in this study, but 12 patients were lost during follow up. Out of the remaining 140 patients of either sex, 74 patients (52.87%) were of category-1 and 66 patients (47.13%) were of category-II. No one in present study population was having type-II diabetes without hypertension. In category-1, 46 patients (62.16%) were male and 28 patients (37.84%) were female.

Table 1: Demographic and clinical characteristics of the study population.

Criteria	Patients with HTN	Patients with type - II diabetes with HTN
No. of Patients	74 (46 male+28 female)	66 (49 male+17 female)
Age Range (in years)	40-89	40-89
Mean Age (in years)	59.64±12.5	58.78±9.18
Mean SBP before ARB therapy (mm/Hg)	152.94±10.91	143.87±7
Mean DBP before ARB therapy (mm/Hg)	89.94±7.25	87.4±5.33
Duration of HTN (in years)	8±4.47	7.67±3.14
Duration of Type- II DM (in years)	0	4.23±2.2

In category-II, 49 patients (74.2%) were male and 17 patients (25.7%) were female. The mean age of the study population in cate-1 and cate-II were 59.64±12.5 years and 58.78±9.18 years respectively.

Mean BP in cate-1 and cate-II patients were 152.94±10.91/89.94±7.25 mm/Hg and 143.87±7/87.43±5.33 mm/Hg respectively.

Antihypertensive drug utilization

Different ARBs used in this study were losartan, telmisartan and olmesartan either as single therapy or in combination with other antihypertensives like thiazide diuretic (HCT), angiotensin converting enzyme inhibitors (ACEI), calcium channel blockers (CCBs) and β-blockers (BB).

Table 2: Utilization pattern of individual angiotensin receptor blockers.

ARB used	No. of patients (%)
Losartan	50 (35.7%)
Telmisartan	66 (47.14%)
Olmesartan	24 (17.1%)
Total	140

In cate-1

Out of 74 patients 16 (21.62%) patients were prescribed with different ARBs as single therapy, 58 (78.3%) patients were treated with ARB based combination like ARB+HCT in 32 (43.24%), ARB+CCB in 15 (20.2%) patients, ARB+ACEI in 9 (12.16%) patients and ARB+BB in 2 (2.7%) patients. In this category, maximum patients (48.6%) were treated with losartan based therapy, followed by telmisartan (35.1%) and olmesartan (16.15%) based therapy. The combination mostly used with losartan was HCT (27%).

In cate-II

Out of 66 patients 33 (50%) were prescribed with different ARBs as monotherapy. 33 (50%) patients were treated with ARB based combination therapy. Maximum patients (60.84%) were treated with telmisartan based regimen. The combination mostly used with telmisartan was hydrochlorothiazide (24.2%).

BP control

The recommended target BP ≤140/90 mmHg was achieved in 37 (50%) patients of cate-1 and ≤130/80 mm Hg was achieved in 13 (19.69%) patients of cate-II.

The baseline BP (SBP/DBP) values of cate-1 and cate-II patients were 152.94±10.91/89.94±7.25 mm/Hg and 143.87±7/87.43±5.33 mm/Hg respectively. The most recently recorded values of systolic and diastolic BP in cate-1 patients were 138.78±6.28 mm/Hg and 85.36±7.42 mm/Hg respectively. In cate-II patients, the values were 134.74±4.3 mm/Hg and 84.19±3.0 mm/Hg respectively. The reduction in BP (SBP and DBP) in either categories of patients treated with different ARBs as single therapy and in combination with other anti-hypertensives were shown in Table 5.

Table 3: Mono- therapy versus different combination therapy in two categories of patients.

Mode of therapy	Category- i pts	Category-ii pts	Total
Monotherapy (only ARB)	16 (21.62%)	33 (50%)	49 (35%)
ARB+HCT	32 (43.24%)	21 (31.8%)	53 (37.8%)
ARB+ACEI	9 (12.16%)	10 (15.15%)	19 (13.57)
ARB+CCB	15 (20.27%)	2 (3%)	17 (12.14%)
ARB+ BETA blocker	2 (2.7%)	NIL	2 (1.42%)
Total	74	66	140

When the effects of different ARBs as single therapy on BP reduction were compared with each other and in both categories of patients, no statistically significant difference was found. In cate-1, when the effect of the corresponding ARB as single therapy was compared with other anti-hypertensive in combination, there was maximum reduction in SBP with losartan in combination with CCB (15±1.41 mm/Hg), followed by losartan in combination with HCT (12±5 mm/Hg) when compared with losartan as single therapy or with other combination. DBP in this losartan based therapy when compared, there was more reduction (6±2.82 mm/Hg) with (losartan+BB) and (6±3.5 mm/Hg) with (losartan+HCT) treated groups in comparison to others. But no group was showing statistically significant reduction when compared with each other.

When it was compared in telmisartan based therapy, telmisartan+CCB showed maximum (13±4.3 mm/Hg) reduction in SBP in comparison to others. Telmisartan as single therapy and telmisartan with CCB caused substantial reduction (6±4.3 mm/Hg and 6±2.82 mm/Hg respectively) in DBP. These reductions were not statistically significant when compared between each type of this group.

Patients treated with olmesartan based therapy, maximum reduction in SBP was with olmesartan and CCB combination (14.3±3.18) mm/Hg, followed by olmesartan and HCT combination (12.8±2.8 mm/Hg). Olmesartan in combination with HCT and CCB, there was 8.6±2 mm/Hg and 7.0±2.1 mm/Hg reduction of DBP respectively but not statistically significant when compared.

In cate-II patients, as shown in Table-5, the mean reduction in SBP in patients treated with losartan based therapy was maximum with losartan in combination with HCT (13±1.41 mm/Hg), but this reduction was not statistically significant when compared with each other.

Again, patients treated with this type of therapy, the reduction in DBP, though not statistically significant, but substantial reduction with losartan in combination with HCT (8±2.82 mm/Hg), followed by losartan in combination with ACEI (7±4.24 mm/hg.) therapy was found in this category, regarding telmisartan based therapy, the reduction in both SBP and DBP was more with telmisartan and ccb combination i.e. (18.0±1.4 mm/Hg) and (8±0 mm/Hg) respectively. The base line values of fasting blood sugar (FBS) for losartan, telmisartan and olmesartan were 179.42±5.68, 182.3±2.91 and 190.83±6.07 mg/dl respectively. The most recently recorded values of FBS were 177.21±4.85 mg/dl, 167.92 ± 2.23 mg/dl and 189.16±3.48 mg/dl for losartan, telmisartan and olmesartan based treated patients. When compared to the baseline values, there was significant reduction ($p<0.001$) of FBS in telmisartan based treatment. Out of total 66 patients in cate-II, 22 (33.3%) patients were having albuminuria. The recent values of albumin excretion rate (AER) in patients treated with losartan was 476.33±4.13 mg/day, with telmisartan and olmesartan were 489.3±3.19 mg/day and 641.33±10.48 mg/day respectively. When this was compared with the corresponding baseline values, there was statistically significant reduction ($p<0.001$) in AER in those, who received telmisartan based therapy and ($p<0.05$) in those, who received olmesartan based therapy.

Table 4: Pattern of use of different ARBs in both categories of patients.

ARB based therapy	Category-i patients (%)	Category-ii patients (%)
Losartan (mono)	6 (8.1)	9(13.7)
Losartan+HCT	20 (27)	2(3)
Losartan+ACEI	4 (5.4)	3(4.5)
Losartan+CCB	4 (5.4)	NIL
Losartan+BETA blocker	2 (2.7)	NIL
Telmisartan (mono)	6 (8.1)	18 (27.3)
Telmisartan+HCT	8 (10.8)	16(24.2)
Telmisartan+ACEI	2 (2.7)	4(6.24)
Telmisartan+CCB	10 (13.5)	2(3)
Olmesartan (mono)	4 (5.4)	6(10.7)
Olmesartan+HCT	4 (5.4)	3(4.5)
Olmesartan+ACEI	3 (4)	3(4.5)
Olmesartan+CCB	1 (1.35)	NIL
Total	74 (100%)	66(100%)

Table 5 : Blood Pressure reduction with different ARB based therapy in two categories of patients.

	Hypertensive patients			Type-ii diabetes patients with HTN		
	N	Reduction in SBP (mm/Hg)	Reduction in DBP (mm/HG)	N	Reduction in SBP (mm/HG)	Reduction in DBP (mm/HG)
Drug therapy administered						
Losartan	6	8.5±1.91	4.5±3.41	9	9.6±1.2	3.3±1.5
Losartan+HCT	20	12±5	6±3.5	2	13±1.41	8±2.82
Losartan+ACEI	4	10.5±1	5±2.58	3	10±2.82	7±4.24
Losartan+CCB	4	15±1.41	5±1.41	-	NIL	NIL
Losartan+BB	2	10±1.41	6±2.82	-	NIL	NIL
Telmisartan	6	9.33±3	6±4.3	18	10±4.3	6±2.8
Telmisartan+HCT	8	9±3.4	4±3.8	16	8.6±3	4.4±1.26
Telmisartan+ACEI	2	8±2.8	5±1.41	4	7±2.7	6±1.4
Telmisartan+CCB	10	13±4.3	6±2.82	2	18±1.4	8.0±0
Olmesartan	4	9.3±2.5	6.2±1.48	6	9±2.3	5.4±1.0
Olmesartan+HCT	4	12.8±2.8	8.6±2	3	14.33±3	10±2.0
Olmesartan+ACEI	3	9±1	6±2	3	8±0.8	6±1
Olmesartan+CCB	1	14.3±3.18	7±2.1	-	NIL	NIL

Table 6: Effects of different ARBs on 24 hours urinary Albumin Excretion in type-II diabetic patients with macroalbuminuria.

No.	Drug	Baseline value (mg/24 hours)	Duration of treatment	Treatment value (mg/24 hours)	P- value
6	Losartan	477.055±5.318	3 months	476.333±4.13	NS
10	Telmisartan	498.3±4.13	3 months	489.3±3.19	0.001**
6	Olmesartan	648.5000 ±11.09504	3 months	641.33±10.48	0.05*

Table 7: Effects of different ARBs on Fasting Blood Sugar in patients of type-II diabetes with hypertension.

No.	Drug	Baseline value (mg/dl)	Duration of treatment	Treatment value (mg/dl)	P- value (paired t - test)
14	Losartan	179.42±5.68	3 months	177.21±4.85	NS
40	Telmisartan	182.3±2.919	3 months	167.9250±2.23	<0.001
12	Olmesartan	190.83±6.07	3 months	189.16±3.48	NS

DISCUSSION

The Renin-angiotensin system plays a crucial role in the pathogenesis of essential hypertension, renovascular hypertension and renal disease associated with albuminuria. The primary effector peptide angiotensin-II functions at two receptors, AT_1 and AT_2. The AT_1 receptor mediates actions like vasoconstriction and aldosterone secretion while the AT_2 receptor mediates vasodilatation and natriuresis. Antihypertensive agents can offer renal protection via two mechanisms on reduction of BP and effects on intrarenal mechanisms of damage, such as glomerular pressure and proteinuria.[18] Arterial BP-lowering effects are common to all antihypertensive drugs. However, intrarenal effects differ among different classes of antihypertensive agents and among individual drugs within certain antihypertensive drug classes.[19] ACEI reduce biosynthesis of angiotensin-II, whereas ARBs completely block AT-I receptors and both are effective anti-hypertensive agents. But currently, there is a constant debate over the comparative efficacy of ACE inhibitors and ARBs due to the possibility of angiotensin-II generation by alternative pathways with the use of ACE inhibitors. Hence, ARBs are said to reduce the activation of AT-I receptors more effectively than ACE inhibitors. The newer ARBs like telmisartan and olmesartan have added advantages over older drugs of this class and that could be due to more receptor selectivity, increased lipophilicity, longer duration of action and PPARγ agonistic action. Thus, this study is important, showing the trend of use of different ARBs as anti-hypertensives, their effectiveness in reducing BP, proteinuria and blood sugar level in type-II diabetics with hypertension.

Present study revealed that most of the patients (47.14%) of either category were prescribed with telmisartan based

therapy, followed by losartan (35.71%) and olmesartan (17.1%).

It is observed that majority (78.3%) of patients in cate-1 were treated with combination (ARB based) therapy and losartan was maximally used either as mono therapy or in combination with other anti-hypertensives. hydrochlorothiazide was the commonest (27%) combination with losartan in this category. In cate-II, 50% patients have been treated with different ARBs as single therapy. Of the remaining 50% patients, who received combination therapy, HCT was the most common (24.2%) combination used with telmisartan.

This combination is pharmacologically favourable, since it produces an additive anti-hypertensive effect and minimizes most adverse effects of either the ARBs or the diuretics, especially on serum potassium conc.[19]

Telmisartan was the most frequently (27.3%) ARB used in this category either as single or combination therapy. ARB based combination therapy provided better BP control in comparison to ARB single therapy.

Among monotherapy in cate-1 patients, olmesartan and telmisartan produced better (9.33±3 and 9.3±2.5 mm/Hg) SBP reduction than losartan (8.5±1.91mm/Hg).

Among combination therapy in two categories of patients ARBs along with CCB produced maximum BP reduction. ARB in combination with HCT also produced substantial SBP reduction, which are found to be superior to ARB monotherapy, but inferior to ARB in combination with CCB. But in our study, use of ARBs in combination with CCB was not very common. Although it could provide synergistic anti-hypertensive and reno protective activity. The popularity of CCB may be due to its reported positive effects on diabetic proteinuria[20]. Telmisartan produced significant reduction in albuminuria, which could be due to its more receptor selectivity, lipophilicity and longer duration of action. This finding is in accordance with several studies done in ARBs.[17]

Out of three ARBs used in this study telmisartan based therapy showed significant glycemic control. But this may not be sufficient to comment on this,as duration and study samples were less.

CONCLUSION

In this study, telmisartan which has added advantages was used maximally either as single or combination therapy specially in hypertensive patients with type-II diabetes, followed by losartn. ARBs have modest anti-hypertensive efficacy in hypertensive patients with or without type-II diabetes. In general, the currently approved angiotensin-II receptor antagonists did not differ substantially with regard to blood pressure lowerinig effects when used as single therapy, however better blood pressure reduction were achieved when any of these agents was administered in combination with calcium channel blocker and hydrochlorothiazide. The study findings support the benefits of adding a second antihypertensive agent to a patient´s antihypertensive treatment regimen. We concluded from this study that, there was a suboptimum use of combination therapy among diabetic hypertensive patients. Furthermore, majority of patients were not on target B.P. Long term studies are needed to evaluate the efficacy in reduction in proteinuria and glycemic contol in type-II D.M with hypertension.

ACKNOWLEDGEMENTS

Author would like to sincerely thanks Prof. Dr. Satyanarayan Routray, And Prof. Dr. Anoj Kumar Baliarsingh for their support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Atlas of End-stage Renal Disease in the United States. Excerpts from the United States Renal Data Systems 2002 annual report. Am J Kidney Dis. 2003;41(2):254.
2. Wenzel RR, Bruck H, Noll G, Schafers RF, Daul AE, Philipp T. Antihypertensive drugs and the sympathetic nervous system. J Cardiovasc Pharmacol. 2000;357(4):S43-52.
3. Perry HM, Miller JP, Fornoff JR, Baty JD, Sambhi MP, Rutan G, et al. Early predictors of15-year end-stage renal disease in hypertensive patients. Hypertension. 1995;25:587-94.
4. Klag MJ, Whelton PK, Randall BL, Neaton JD, Brancati FL, Ford CE, et al. Blood pressure and end-stage renal disease in men. N Engl J Med. 1996;334:13-8.
5. Young JH, Klag MJ, Muntner P, Whyte JL, Pahor M, Coresh J. Blood pressure and decline in kidney function: findings from the systolic hypertension in the Elderly Program (SHEP). J Am Soc Nephrol. 2002;13:2776-82.
6. Ruilope LM, Segura J. Losartan and other angiotensin 11 antagonists for nephropathy in type 2 diabetes mellitus: a review of the clinical trial evidence. Clin Ther. 2003;25:3044-64.
7. Grundy SM, Benjamin IJ, Burke GL, Chait A, Eckel RH, Howard BV, et al. Diabetes and cardiovascular disease. A statement for healthcare professionals from the American Heart Association. Circulation. 1999;100(10):1134-46.
8. Intensive blood-glucose control with sulphonylurea or insulin compared with conventional treatment and risk of complications in patients with type-2 diabetes mellitus (UKPDS 33). UK Prospective

Diabetes Study (UKPDS) Group. Lancet. 1998; 352(9131):837-53.
9. Epstein M, Sowers JR. Diabetes mellitus and hypertension. Hypertension 1992;19(5):403-18.
10. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12-years cardiovascular mortality for men screened in the multiple risk factor intervention trial. Diabetes Care. 1993;16(2):434-44.
11. Cushman WC. Are there benefits to specific antihypertensive drug therapy? Am J Hypertens. 2002;6:31S-35S.
12. Blood Pressure Lowering Treatment Trialists, Collaboration. Effects of different blood-pressure lowering regimens on major cardiovascular events: Results of prospectively-designed overviews on randomized trials. Lancet. 2003;362:1527-35.
13. Bakris G, Burgess E, Weir M, Davidai G, Koval S. Telmisartan is more effective than losartan in reducing proteinuria in patients with diabetic nephropathy. Kidney Int. 2008;74(3):364-9.
14. American Diabetes Association. Standards of Medical Care in Diabetes. Diabetes care. 2008;31:S12-S54.
15. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. Hypertension. 2003;42:1206-52.
16. Ball SG, White WB. Debate: Angiotensin-converting enzyme inhibitors versus angiotensin 11 receptor blockers-A gap in evidence-based medicine. Am J Cardiol. 2003;91:15G -21G.
17. Ishimitsu T, Yagi S, Ebihara A, Doi Y, Domae A, Shibata A. Long term evaluation of combined antihypertensive therapy with lisinopril and a thiazide diuretic in patients with essential hypertension. Japan Heart J. 1997;38(6):831-40.
18. Salvetti A, Mattei P, Sudano I. Renal protection and antihypertensive drugs: Current Status. Drugs. 1999;57:665-93.
19. Susic D, Frohlich ED. Nephroprotective effect of antihypertensive drugs in essential hypertension. J Hypertens. 1998;16:555-67.
20. Bakris GL, Weir MR, DeQuattro V, McMohan FG. Effects of an ACE inhibitor/ calcium antagonist combination on proteinuria in diabetic nephropathy. Kidney Int. 1998;54(4):1283-9.

Cite this article as: Samal R, Panda JP, Pattnaik KP. Study of utilization pattern and analysis of efficacy of newer angiotensin receptor blockers in patients with hypertension and type-II diabetes with or without hypertension. Int J Res Med Sci 2017;5:2931-7.