ADHERENCE FOR BENZANTHINE PENICILLIN AS SECONDARY PROPHYLAXIS AND FACTORS ASSOCIATED WITH IT AMONG CHILDREN WITH RHEUMATIC HEART DISEASE ATTENDING THE CARDIAC CLINIC OF JIMMA UNIVERSITY SPECIALIZED HOSPITAL FROM 2011-2015 GC.

BY

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Adherence for benzanthine penicillin as secondary prophylaxis and factors associated with it among children with rheumatic heart disease attending the cardiac clinic of Jimma University Specialized Hospital from 2011-2015 GC.

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ABSTRACT

Background: Secondary prophylaxis is directed at preventing acute GAS pharyngitis in patients at substantial risk of recurrent acute rheumatic fever. Intramuscular benzanthine penicillin is the most effective method for secondary prophylaxis against acute rheumatic fever whose efficacy largely depends on adherence to treatment. The level of adherence required to prevent further episodes of ARF is not known, but the objective is to reach 100% of the annual expected BPG injections, with a recommended benchmark of 80%.

Objective: The objective of this study was to assess adherence for benzanthine penicillin as secondary prophylaxis and factors associated with it among children with rheumatic heart disease attending the cardiac clinic of JUSH, Jimma, Ethiopia from 2011-2015 GC.

Methods: A longitudinal cohort study, with study population of children with documented rheumatic heart disease or acute rheumatic fever who were on monthly benzanthine G penicillin prophylaxes was done by analyzing a secondary data which was collected by the Rheumatic Heart Disease Registry (REMEDY) group over 2 years. Data was analyzed using SPSS version 21, and appropriate description for the study variables is depicted by cross-tabulation, graphs and association of variables were done using chi-square, linear logistic regression accordingly with p-value <0.05 used as significant for associated variables.

Results: This study showed that at both 1st & 2nd year of study majority of the children were adherent to BGP prophylaxis with rates of 91% & 86% respectively. There were 12 (3/1st year, 9/2nd year) children who received no injection at all. Use of other cardiac supportive drugs was a protective factor against poor adherence (OR, 0.14; 95% CI, 0.03-0.85), while disease severity & type of valves involved weren't predictors for adherence to BGP.

Conclusion: Although the adherence level of this study was good, further improvement of patients and caregivers understanding of the disease & the benefits of BGP adherence should be sought.

Key words

Benzanthine penicillin, secondary prophylaxis, rheumatic heart disease, adherence.

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ACRONYMS

ARF-Acute Rheumatic Fever

AV- Aortic valve

BGP- Benzanthine G penicillin

CHF- Congestive Heart Failure

CXR-Chest x-ray

ECHO- Echocardiography

GABHS-Group A B Hemolytic Streptococcus

JUSH- Jimma University Specialized Hospital

MV- Mitral valve

PV- Pulmonic valve

RHD- Rheumatic Heart Disease

REMEDY- Rheumatic Heart Disease Registry

SP-Secondary prophylaxis

TV- Tricuspid valve

INTRODUCTION

Background: Acute rheumatic fever (ARF) is a non suppurative inflammatory disease which usually follows streptococcal pharyngitis and involves primarily the heart, joints, subcutaneous tissues, and central nervous system. In its classic form, ARF is acute, febrile, and largely self-limited. However, damage to heart valves may occur, and such damage may be chronic and progressive and lead to severe cardiac failure, total disability, and, not infrequently, death many years after the acute attack. The heart is involved in about half of the cases and hence is called rheumatic heart disease (RHD) [1].

The severity and prognosis of RHD depends on the extent of cardiac involvement and the frequency of recurrent events [2-5]. The risk of rheumatic fever (RF) after an untreated group A beta-hemolytic streptococcal (GABHS) infection in healthy children is around 3%; however in children with a previous episode of RF, this risk increases to more than 50%, emphasizing the importance of secondary prophylaxis [6].

Secondary prophylaxis is the terms used to describe regular delivery of antibiotics to prevent recurrence of GAS infection and subsequent development of ARF. Secondary prophylaxis is recommended for all people who have a history of ARF or RHD. The most effective method of secondary prophylaxis is Benzanthine penicillin G given by intramuscular injection every 3 or 4 weeks. Oral Erythromycin is used if there is an allergy to Penicillin [7]. It has been shown to significantly reduce the morbidity and mortality associated with both recurrent ARF and RHD [8, 9]. Adherence to penicillin prophylaxis is therefore essential to prevent rapid progression of disease.

The appropriate duration of secondary prophylaxis is determined by a number of factors, including age, time since the last episode of ARF, ongoing risk of streptococcal infections and potential harm from recurrent ARF [2, 10, 11].

However, ensuring adequate adherence to secondary prophylaxis for RF has been a challenging task, as with most chronic treatments, adherence is usually poor [12-15].

Statement of the problem

In developing countries, rheumatic fever (RF) is the predominant cause of acquired childhood cardiomyopathy [7]. It accounts for up to 1.4 million deaths per year [16]. Historically, sub-Saharan Africa has had the greatest prevalence of clinically detected RHD, ranging from less than 1 to 14 per 1000 [17]. Ethiopia as one of the African countries shares the burden of ARF. Accordingly, 50–64% of heart disease among children was reported to be of rheumatic origin [18]. The 2010 Global Burden of Disease study demonstrated that RHD remains one of the leading cardiovascular causes of disability‐adjusted life years lost in those aged <25 years[19].

The severity and prognosis of RHD depends on the extent of cardiac involvement and the frequency of recurrent events. Since the 1980s, recommendations of the World Health Organization (WHO) it promotes secondary prevention as the cornerstone of control programs [20].

Nevertheless, poor adherence to treatment is the main impediment to secondary prevention. Defined as the concordance between the patient's behavior and the care provider's recommendations [21], adherence is a rate that can range from 0 to more than 100% [22]. The notion of adherence proposes an alliance relationship, whereby therapeutic guidance should be agreed upon between patient and health professional, thus recognizing partial autonomy of the patient with regard to how treatment is followed. Adherence is considered a multidimensional phenomenon as many factors interact and interfere with it. These include: the social and economic factors, the health care team system, and the characteristics of the disease, disease therapies and patient-related factors. Solving the problems related to each of these factors is necessary if patients' adherence to therapies is to be improved for the consequences of poor adherence to long-term therapies are poor health outcomes and increased health care costs. [23]

Adherence with prophylactic benzanthine penicillin appears even lower in the African context, being only of 37.5% after 3 months in Congo and this low compliance has mainly been reported to be associated with the target population's mobility, understaffing and remote settings [24].

Multiple measures of adherence to secondary prophylaxis of ARF were assessed since the 1970s, using various tools, such as the annual rate of BPG injections, the percentage of positive-for-penicillin urines, or the time interval and attendance at visiting specialist and echocardiographic appointments, but only few studies aimed at determining the factors associated to adherence [6,

14, 25-29]. Even though the level of adherence required to prevent further episodes of ARF is not known, the objective is to reach 100% of the annual expected BPG injections, with a recommended benchmark of 80% [11]. Patients receiving less than 80% of prescribed doses are considered at high risk of recurrence of ARF [30].

There is evidence that establishing register-based control programs will, in itself lead to improved adherence with secondary prophylaxis regimens, but the specific ways to dramatically improve the proportion of scheduled benzanthine penicillin G injections that are actually delivered are still largely been ignored. Based on current knowledge, some of the new strategies that could be included as trails for improvement of adherence are: implementation of continuous quality improvement approaches, allocating responsibility for RHD care to particular primary health center staff, streamlining care in clinics so that people are not kept waiting for routine injections, implementing an active recall process (which might include mobile phones or text messages), using information technology to track patients from mobile populations in order to continue prophylaxis at other centers, delivering BPG injections in homes and schools, intensive training for health center staff on RHD management including pain-minimizing injection techniques, patient empowerment strategies such as hand-held records or prescriptions, and use of community mobilization (including community workers, patient support groups) [31, 32].

Significance of the study

The results of this study will help to solidify and also improve existing care provided for children with ARF/RHD.

It'll also serve as baseline information for further study.

LITERATURE REVIEW

Rheumatic heart disease is one of the leading non-communicable diseases in low and middle-income countries [16] & worldwide at least 15.6 million people are estimated to be affected [17]. In our country, Ethiopia, it is documented that the prevalence of RHD among cardiac patients in Addis Ababa city and Jimma town was 39.6% and 32.8%, respectively [33, 34]. Another study also screened 4720 school children with age ranging from 4-24 years for RHD in South Africa and Ethiopia & it showed prevalence of 31 cases per 1000 in Ethiopia [35].

People with a history of RF are at high risk of recurrent attacks and of developing rheumatic heart disease following a streptococcal throat infection. Giving penicillin to these people can prevent recurrent attacks of RF and subsequent rheumatic heart disease [20]

Retrospective study from 1985 to 2005 took place in the Pediatric Rheumatology outpatient clinic at a tertiary care hospital in Brazil in order to assess adherence to secondary prophylaxis and disease recurrence among 536 children with rheumatic fever. Recurrent episodes of RF occurred in 88 of 536 patients (16.5%) among which 54.5% were non-adherent to secondary prophylaxis, & 14.5% of them reported adherence to prophylaxis [27].

To identify factors that affect rheumatic fever prophylaxis for remote-living Aboriginal patients, and to determine the proportion who received adequate prophylaxis a study was done in Australia using the principles of grounded theory. Fifteen patients with RHD or a history of rheumatic fever, 18 relatives and 18 health care workers were interviewed. It showed that patients did not generally refuse injections, and 59% received adequate prophylaxis (> 75% of prescribed injections) [6].

A retrospective cohort study done in Lifou also showed that 46% of patients, out of 70 patients, receiving antibiotic prophylaxis for ARF or RHD had a rate of adherence <80% and were therefore at high risk of recurrence of ARF [36].

A study in Iran evaluated the RF recurrences to verify the clinical features of the disease and to determine the related risk factors in recurrences among patients with a past history of RF, from March 1995 to March 2001. Out of the 38 patients with recurrent RF, 37(97.4%) cases were not on penicillin prophylaxis at the time of recurrence. The discontinuous injection of penicillin in these patients had 2 major reasons. In 15(39.5%) patients medical staff were responsible such that in 4(10.5%) cases physicians did not explain the need for secondary prevention, in 5(13.2%) subjects due to a drop in the acute phase reactants titers in laboratory tests, other physicians

stopped the prevention protocol, in 5(13.2%) cases physicians did not emphasize the need for monthly injections on a long-term course, and in one case(2.6%) the nurse responsible for injection suggested that the prophylactic regimen should be stopped. In 22(57.9%) of the 37 patients, the family or the patients themselves were responsible for prophylaxis discontinuation. Among these, 6(15.8%) patients did not comply with chemoprophylaxis; in 2(5.3%) subjects this was due to suggestions of their friends or family, and in 14(36.8%) cases their parents did not comply with long-term benzathine penicillin injection [37].

A study was conducted in in Haryana, India to evaluate the compliance of secondary prophylaxis for controlling RF and RHD. Of the 110 patients registered in RF/RHD registry, more than 90% had taken 11 out of the 12 due doses of secondary prophylaxis every year in the last eight years of the program except in 1995 when 92 (83.6%) patients took the prophylactic doses. Only one patient reported recurrent attacks of rheumatic fever after irregular secondary prophylaxis [14].

A descriptive cross-sectional survey was done among 39 clients diagnosed with rheumatic fever and receiving penicillin G prophylaxis for more than a year in in Kingston, Jamaica to determine the level of adherence and possible barriers to secondary prophylaxis. It showed that only 48.7% had a high level of adherence [38].

A longitudinal observational study was done in Mulago National Referral Hospital, Kampala, Uganda from June 2011 to March 2012 to determine the levels of adherence with benzathine prophylaxis among rheumatic heart disease patients. Ninety five rheumatic heart disease patients were recruited and followed up for a period of 6months for their adherence levels and associated factors. Of the 82 patients who completed the 6 months follow up, 54% had adhered to the monthly benzathine penicillin prophylaxis, with adherence rates $\geq$ 80% and the rest 46% were classified as non-adherent, with rates less than 80%. The commonest reason for missing a dose was the painful nature of the benzathine penicillin injection, reported by 27 respondents (29% of all reasons given). This was closely followed by lack of transport money to the health facility to receive the injection. The other reasons included injection abscesses, attendant too busy at home with children and unable to go for the injection, they thought it was acceptable to miss a few times, one patient had valvular surgical repair and was advised by the local health practitioner that there was no need for any more injections [39].

A cross-sectional study was conducted in specialist children's hospitals in Alexandria, which aimed to evaluate the current regimen of secondary prophylaxis for children suffering from

rheumatic heart disease. Two-thirds of the patients had complied with their prophylactic regimen. Recurrence of rheumatic fever was recorded in 37.3% of the patients [25].

A study was done in Auckland, New Zealand in order to assess the compliance rates with the rheumatic fever secondary prophylaxis program established through the Auckland Rheumatic Fever Register and managed by community nursing service. It included all patients on ARF Register from 1998 to 2000 & result showed a compliance rates ranging from 79.9% to 100% [43].

OBJECTIVES OF THE STUDY

General objectives:

- To assess adherence for benzanthine penicillin as secondary prophylaxis and factors associated with it among children with rheumatic heart disease attending the cardiac clinic of Jimma University Specialized Hospital from 2011-2015 GC.

Specific objectives:

- To assess level of adherence for benzanthine penicillin as secondary prophylaxis among children with rheumatic heart disease attending the cardiac clinic of Jimma University Specialized Hospital from 2011-2015 GC.

- To identify factors associated with adherence for benzanthine penicillin as secondary prophylaxis among children with rheumatic heart disease attending the cardiac clinic of Jimma University Specialized Hospital 2011-2015 GC.

METHODOLOGY

Study Area and study period

The study was done at Jimma University Specialized Hospital, located in Jimma town, Pediatrics and Child Health department pediatric cardiac clinic. The hospital gives service to 15million population including those who are referred, and have different departments among which Pediatrics and child health department is one. The department has five major wings: level-I, level-II, nutritional rehabilitation unit (NRU), neonatal intensive care unit (NICU) and OPD. The cardiac clinic is at every Fridays starting from 2:00PM and evaluates and follows children with cardiac diseases (congenital and acquired). The clinic is attended by pediatric cardiologist and third year residents. There are more than 700 children with heart disease, of which more than 60% of them are with RHD. Every week at least 20-25 children with ARF/RHD are seen.

The study has assessed a two year data collected from 2011-2015 GC (Total time taken for the REMEDY STUDY from enrollment to end of 24month follow up)

Study Design

For this study used a secondary data prospectively collected for the REMEDY study over 2years period, the current study design was a longitudinal cohort study.

Source population

All pediatric cardiac patients with rheumatic heart disease on follow up at Jimma University Specialized Hospital, pediatric cardiac clinic were the source population.

Study population

The study populations were those children with RF/RHD enrolled in to the REMEDY study & & those who completed at least the 12months follow up.

Sample size

For the data used was secondary data from the REMEDY study which included a total of 202 participants out of which 154 children were below the age of 18years of which only 103 children completed first year study, the current sample size used was 103.

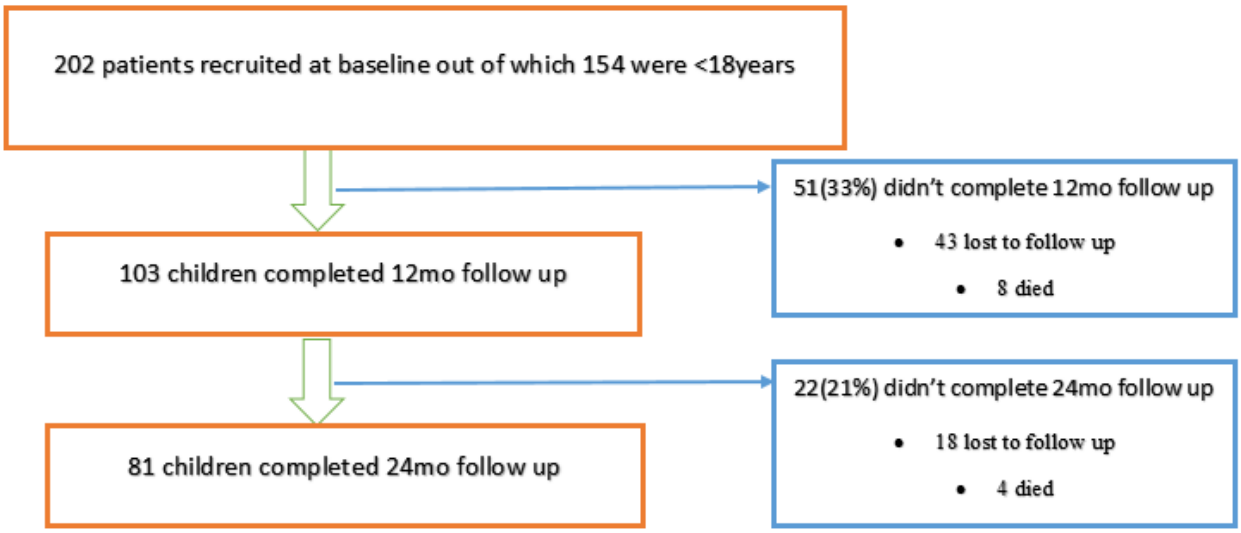

Fig. 1. Flow of children during the study period

Data collection and measurements

The tools used for data collection were the questionnaires filled for the REMEDY study. After getting the permission these questionnaires where accessed from the store & were reviewed.

Data analysis and interpretation

Data was encoded into EpiData version 3.1 & was exported to SPSS statistical package version 21. Logistic regression was used to examine the association between potential factors and the likelihood of a favorable outcome. Odds ratios (OR) and 95 percent confidence intervals (CI) were used to quantify the strength of these associations. P- Value of less than 0.05 was considered to indicate statistical significance. Variables with a two-sided p value <0.25 were introduced in to the multivariable logistic regression model. Multiplicative interactions were tested for their significance at the 0.05 level. Results of the analyzed data were displayed in tables, figures & descriptive form. The results were compared with regional, national and international figures.

Study Variables

Dependent variable

- ✓ Adherence for secondary prophylaxis (benzanthine penicillin)

Independent variables

- ✓ Age
- ✓ Sex

- ✓ Address
- ✓ Relationship of attendant
- ✓ Level of education
- ✓ Vital signs
- ✓ Weight
- ✓ Height
- ✓ Type of valvular lesion
- ✓ Severity of disease
- ✓ BGP dose
- ✓ No of BGP injections
- ✓ Other medications
- ✓ Other morbidity

Operational definitions:

Adherence: Patients were classified as adherent to BGP when they at least had received 80% of their injections.

Children: includes those who are less than 18 years.

Educational status: highest level of formal education completed by the patient; for those younger than 7years, it refers to maternal formal education level.

Cardiac Supportive drugs: drugs taken by the patient other than BGP (theses are- Furosemide, calcium channel blockers, ACE-Inhibitors, digoxin, B-adrenergic).

Other comorbidity: it is used to refer to HIV infection.

Died: children who passed away during the study period.

Lost: refers to children who failed to complete the study or those who defaulted.

Ethical clearance

Ethical clearance was sought from Jimma University, College of health sciences ethical review board and was given to Schools Director. Permission was granted from the sub-studies subcommittee of REMEDY to use the secondary data. Ethical clearance was also obtained for the first study from the former College of Public & Medical Science ethical review board, called College of Health Sciences of Jimma University now as well. Great care was given to keep the

confidentiality of personal information extracted from the secondary data throughout the data collection, analysis and interpretation period.

Dissemination plan

The result of this study will be disseminated to Jimma University College of health science, CBE office; Pediatrics & Child Health department and a copy of it will be kept in University Health science library for all concerned individuals and bodies. Efforts to publish the results of this study will be done as per permission of the REMEDY study group.

RESULTS

From a total of 154 children enrolled at baseline and fulfilled the inclusion criteria, 103 (67%) completed 12 months follow up; 51 (33%) did not complete because 8 had died and 43 (27.9%) were lost to follow up. On the 24 months follow up 81 children completed the study while [18 (17.4%- lost to follow up) & 4-death] children didn't (Fig. 1.).

Table 1 shows baseline general characteristics of the children who completed first year follow up. The majority of the children were females (59, 57.3%) & the age of the children ranged from 5-17 years, with a mean age of 11.01 years (SD 2.88) and median of 11 years. Majority of the children's age lied b/n 10 & 14 years (61, 59.2%). Only 12 (11.7%) of them resided in Jimma town while the rest where outside Jimma. Sixty two (60.2%) of the patients had primary & secondary educational level while 41 (39.8%) of them were illiterate. Most of the children were attended by their parents (96, 93.2%). Most of the patients were either NYHA class I (38, 36.9%) or II (37, 35.4%). The most common valvular lesions were combined mitral and other valve lesions 75 (72.8%) followed by isolated mitral valve 28 (27.2%) involvement. The minimum duration among the study population since the start of BGP was 8 months and maximum was 158 months. All children had taken their BGP every 4weeks & the median number of injections received was 12 (range 0–13). There were 64(62.1%) children who were receiving other cardiac supportive drugs. All the children's serostatus was nonreactive.

Table 1. First year general characteristics of the children with RHD taking BGP at cardiac clinic of JUSH.

Variable	**Level of adherence**	
	Good (n=94)	Poor (n=9)
Age		
<9yr	31 (30%)	4 (4.9%)
10-14yr	57 (55.3%)	4 (3.9%)
15-18yr	6 (5.9%)	1 (1%)
Gender		
Male	41 (39.8%)	3 (2.9%)
Female	53 (51.5%)	6 (5.8%)

Level of education		
Primary & secondary school	57 (55.3%)	5 (4.9%)
Illiterate	37 (35.9%)	4 (3.9%)
R/n ship of attendant		
Parents	87 (84.5%)	9 (8.7%)
Others	7 (6.8%)	0
Residence		
Jimma town	12 (11.7%)	0
Outside Jimma	82 (79.6%)	9(8.7%)
Severity of disease		
NYHA I	36 (35%)	2 (1.9%)
NYHA II	34 (33.1%)	3 (2.9%)
NYHA III	22 (21.4%)	2 (1.9%)
NYHA IV	2 (1.9%)	2 (1.9%)
Valves involved		
Isolated MV	27 (26.2%)	1 (1%)
MV+others	67 (65%)	8 (7.8%)
Duration of monthly BGP prophylaxis		
<3 years	69 (66.9%)	9 (8.8%)
4-6 years	8 (7.8%)	0
≥7 years	17 (16.5%)	0
Cardiac supportive drugs		
No	33 (32.1%)	6 (5.8%)
Yes	61 (59.2%)	3 (2.9%)

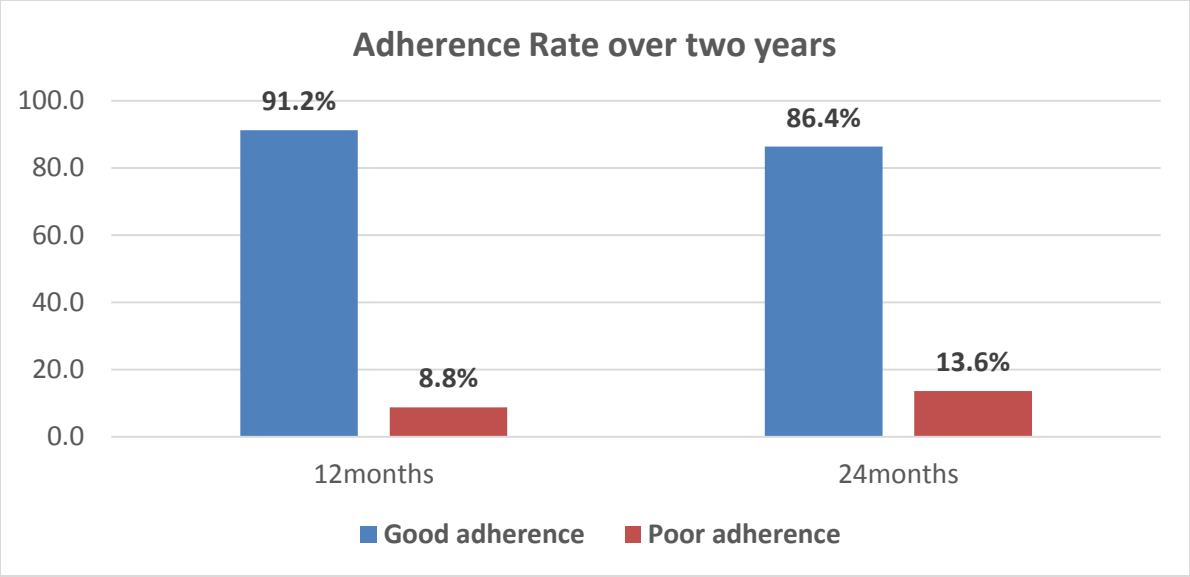

Fig. 2. Bar graph showing the rate of adherence over the two year follow up period among children with RHD taking BGP at cardiac clinic of JUSH from 2011-2015 GC.

As depicted above in fig. 2 the level of adherence to BGP at 12 & 24 months of follow up was good (94, 91.2%: 70, 86.4%), with adherence rates ≥80%. Nine (8.8%) children in the 1st year & 11 (13.6%) children in the 2nd year were classified as non-adherent to the monthly BGP, with rates less than 80%.

There were 3 children in the 1st year & 9 children in the 2nd year of follow up who weren't taking their BGP monthly prophylaxis at all with adherence rate of 0 (Fig. 3).

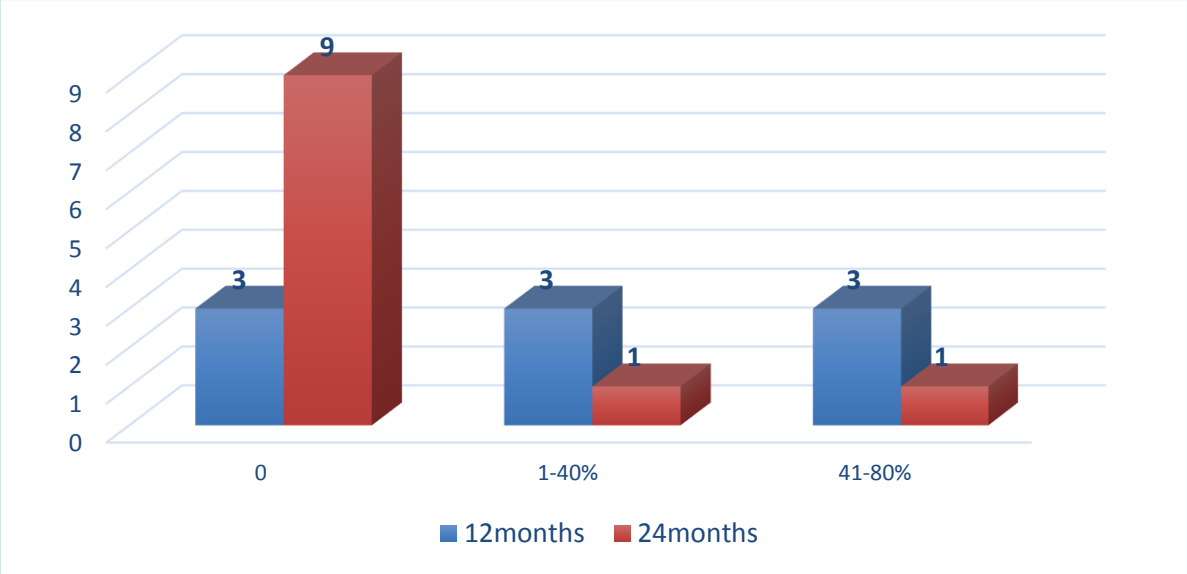

Fig. 3. The level of adherence of children with poor compliance to BGP at cardiac clinic of JUSH from 2011-2015 GC.

The bivariable regression model assessed those factors which had difference over time & those which were associated with adherence and showed that use of other cardiac supportive drugs for both years & disease severity as well valves involved at first year were significant (Table 2).

Table 2. Bivariable regression model showing the factors associated with BGP adherence among children with RHD at cardiac clinic of JUSH from 2011-2015 GC.

Variable		**Level of adherence**		**COR(95%CI)**	**P-value**
		Good	**Poor**		
		Frequency(%)	Frequency(%)		
Year of study	First year	94(91.2%)	9(8.8%)	1	0.30
	Second year	70(86.4%)	11(13.6%)	1.64(0.65-4.2)	
Cardiac supportive drugs					
First Year	no drug	33(32.1%)	6(5.8%)	1	**0.07**
	≥1 drug	61(59.2%)	3(2.9%)	0.27(0.06-1.15)	
Second Year	no drug	39(48.1%)	9(11.1%)	1	**0.12**
	≥1 drug	31(38.3%)	2(2.5%)	0.28(0.06-1.4)	
Valves					
First Year	Isolated MV	27(26.2%)	1(1.0%)	1	**0.28**
	MV+ others	67(65%)	8(7.8%)	0.31(0.04-2.6)	
Second Year	Isolated MV	11(13.6%)	2(2.5%)	1	0.87
	MV+ others	59(72.8%)	9(11.1%)	0.84(0.16-4.4)	
Severity of disease					
First year	NYHA **I&II**	70(68.0%)	5(4.8%)	1	**0.23**
	NYHA **III&IV**	24(23.4%)	4(3.8%)	2.33(0.58-9.4)	
Second year	NYHA **I&II**	63(77.8%)	10(12.6%)	1	0.92
	NYHA **III&IV**	7(8.6%)	1(1.0%)	0.9(0.1-8.1)	

Predictors of adherence

Statistically significant association with adherence was found with use of other cardiac supportive drugs for the first year of study. But for the second year there was no significantly associated variable.

Table 3. Multivariable analysis of poor adherence among children with RHD at cardiac clinic of JUSH from 2011-2015 GC.

Variable	Year of study	
	First	Second
	AOR (95%CI)	AOR (95%CI)
Valves		
MV	1	1
MV + Others	5.46 (0.54-55.55)	1.04 (0.19-5.78)
Severity of disease		
NYHA I&II	1	1
NYHA III&IV	2.26 (0.47-10.99)	1.00 (0.104-9.68)
Cardiac supportive drugs		
Yes	0.14 (0.03-0.66)*	0.28 (0.06-1.4)
No	1	1

***, significant level at P<0.05**

DISCUSSION

In this study at both follow up year's females outnumbered males (57.3% Vs 42.7% in the 1st year & 54.3% Vs 45.7% in the 2nd year) which also was seen in previous studies done among school children in Jimma showing female predominance of 51% [2] & also in rural town of Butajira where majority were females [44]. This shows that RHD is more common in females [45].

There was a significant decrement (by half %) among the number of children taking other cardiac supportive drugs in the second year as compared to that of the first year. This could be because, those previously taking these drugs had stopped either because the physician ordered or the patient or family themselves discontinued as well the 22 children who were lost to follow up. In contrary the severity of the disease especially those children at NYHA I had increased by 26.3% in the second year while the other stages of severity has shown decrement. This can be due to those children who were asymptomatic at first year of study had possibly progressed to NYHA I.

A patient with rheumatic heart disease is expected to receive at least 80% of the annual prescribed injections. Receiving less than 80% of the injections places an individual at a higher risk of recurrent ARF and its complications [30]. In this study, adherence was considered as when a patient had received at least 80% of the required injections over a period of one year. An adherence level of at least 80% was found among 94 (91.2%) & 70 (86.4%) children at 1st & 2nd year of follow up respectively. This figure is comparable with an Indian study where the use of a central register was associated with an adherence rate of 92% [14] & also New Zealand's study which reported a high level of adherence, 79.9%-100%, where the majority of prophylaxes were given at school, work, home, or at a community nurse-run clinic [43]. On the other hand as compared to other studies whose adherence rate varies from 48.7% to 64.6% in Australia, Egypt, Brazil, Mulago/Uganda & Jamaica, the result of this study is higher [6, 25, 27, 38, 39]. The variability in levels of adherence may reflect the different systems in which these studies were done, duration of follow up, the different factors that may influence adherence, the individual study designs, and the different cut-off points used for defining adherence in the different studies.

The median number of injections for current study recorded 12 and ranged from 0 to 13 injections. This result is almost similar with the median number of injections reported for the clients in Jamaica which was 12 injections (range 3-13) [38] while that of Lifou's was 14 and ranged from 2 to 18 which is above current study's result [36].

Even though it was difficult to assess all possible factors affecting adherence by this study, for it used a secondary data, three factors (valves involved, disease severity & use of other cardiac supportive drugs) were analyzed in the multivariable regression model. Of this, use of other cardiac supportive drugs was shown to be a positive predictor of adherence to BGP for the first year only and that the other two weren't for both year of follow-up. A study done in Mulago/Uganda also showed that disease severity wasn't significant predictor to BGP adherence [39].

Those children taking other supportive drugs were less likely to be poor adherent to BGP as compared to those children who didn't take these other drugs. This can be reasoned out as, for these children come to cardiac clinic for follow-up, drug refill & echocardiography, they will be reminded among other things, not to miss their monthly BGP dose. The fact that use of other cardiac supportive drugs wasn't a predictor of adherence to BGP in the second year, can be due to either decrement in the number of children using these other drugs, children lost to follow-up & change in variability of factors effect over time.

Even if this study didn't assess other factors; in studies done elsewhere, factors related to the lack of adherence were: lower education of the parents, living in rural or semi-urban areas, low parental knowledge about the disease, dissatisfaction of the family with care [25] and fear of receiving injections [39]. In a study from Lifou, New Caledonia, household with more than five people, a previous medical history of symptomatic ARF and an adequate healthcare coverage were protective factors against poor adherence [36].

Limitations

For this study used a secondary data, it was difficult to assess all possible factors affecting adherence to BGP among the children with RHD. The small number of sample size used as well the fact that questionaries' were primarily filled as per the words of the children or parents & liability to recall bias; were also other limitations making the results of this study be difficult for reflection onto the general population.

CONCLUSION AND RECOMMENDATION

Conclusion

Although the adherence level of this study was good at both year of follow up, still there were significant number of children who had discontinued their monthly injections. It had also determined that use of other cardiac supportive drugs was found to be significantly associated with adherence to BGP prophylaxis.

Recommendation

As secondary prophylaxis is the WHO-recommended cost effective first step to ARF/RHD control, I therefore recommend that even if most of the children were having good adherence level, measures should be taken to improve adherence among those who were having poor compliance. These are:

To health professionals

- Improving patients and caregivers understanding of disease chronicity & the changes to expect as well the benefits of BGP adherence.

To health professionals & managers

- Making BGP administration register based so that recall bias could be avoided, credibility be increased & control be strengthened.

To researchers

- To perform other study having large sample size & also including all possible associated factors.

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QUESTIONNAIRE

Registration

I. Has the patient signed informed consent form? □ No □ Yes

II. Inclusion criteria

a. Has the patient been diagnosed with ARF &/or RHD? □ No □ Yes

b. Does the patient have an address for follow up? □ No □ Yes

c. Is the patient willing to provide contact information of relatives? □ No □ Yes

d. Is the patient willing to participate for the full duration of the study (24 months)? □ No □ Yes

III. Exclusion criteria

a. Is there is any evidence of valve disease which has been caused by a disease process other than RHD? □ No □ Yes

IV. Is the patient eligible to continue? □ No □ Yes

Subject's contact details:

a) Name_____

b) Hospital # _____

c) Home address_____

d) Contact person (primary) _____

e) Contact person (secondary) _____

f) Local physician/clinic _____

Visit Date_____

1. Visit and medication adherence

Did participant complete follow-up clinic visit? □ No if no, complete the rest of the question □ Yes

□ Information obtained by telephone visit

□ Information obtained through third party

□ Refuses further participation

□ Lost

□ Died

2. Contact Information Update: has any of the following information changed for this participant since their last visit No Yes

a) Name □ □

b) Hospital # □ □

c) Home address □ □

d) Primary or Secondary Contact Person□ □

e) Local physician or clinic □ □

3. Measurements:

Systolic Diastolic

a) Blood pressure _____ _____ b)Pulse rate _____bpm

b) Weight _____Kg d)Irregular rhythm □ No □ Yes

e) Height _____cm

4. Status of the current visit:

a) Symptoms:

□ Asymptomatic □ Chest pain □ Routine clinic visit

□ Dyspnea □ Fever □ Palpitations

□ Syncope □ Fatigue □ Other, Specify_____

5. Events:	No	Yes	Number of episodes
a) CHF	□	□	□
b) stroke/TIA	□	□	□
c) Hospitalization	□	□	□
d) Major bleeding	□	□	□
e) Infective endocarditis	□	□	□
f) Prosthetic valve thrombosis	□	□	□
g) ARF	□	□	□
h) Valvuloplasty	□	□	□
i) Valve surgery	□	□	□
J) Systemic embolism	□	□	□
k) Atrial Fibrillation/Flutter	□	□	□

6. Pregnancy: (for women only)

Has this participant become pregnant since her last visit? □ No □ Yes

7. Most recent ECG:

a) Was an ECG performed at this visit? □ No □ Yes

8. Most recent CXR:

a) Was a chest x-ray (CXR) performed within the last 12 months? □ No □ Yes

9. Echocardiography:

a) Was an echocardiography done at this visit? □ No □ Yes

Valve lesions

b) Does the patient have prosthetic valve? □ No □ Yes

c) Has the patient had an annuloplasty? □ No □ Yes

d) Mitral valve	Absent	Present -------Mild	Moderate	Severe
Regurgitation	□	□	□	□
Stenosis	□	□	□	□

Calcification □No □Yes

Stenosis □No □Yes

e) Aortic valve	Absent	Present -------Mild	Moderate	Severe
Regurgitation	□	□	□	□
Stenosis	□	□	□	□

Calcification □No □Yes

Stenosis □No □Yes

f) Tricuspid valve	Absent	Present -------Mild	Moderate	Severe
Regurgitation	□	□	□	□
Stenosis	□	□	□	□

Calcification □No □Yes

Stenosis □No □Yes

g) Pulmonary valve	Absent	Present -------Mild	Moderate	Severe
Regurgitation	□	□	□	□
Stenosis	□	□	□	□

Calcification □No □Yes

Stenosis □No □Yes

Medications

10. Secondary prophylaxis:

A, Has the patient ever used secondary prophylaxis?

□No □Yes ----- specify – Benzanthine penicillin, oral agents

------specify- currently on SP, past use of SP

B, Approximate date of commencing SP _____ □IM □PO

i) BGP dose---------- □4wkly □3wkly □2wkly

No of injections received in the past year_____

% adherence_____

ii) Oral agents

No of oral prescription filled in the past year_____

% adherence_____

11. Oral anticoagulation:

a) Is patient in sinus rhythm? □No ECG available □No □ Yes

□ Yes

If no, has oral anticoagulation been prescribed? □No □ Yes (Warfarin,Acenicoumalone, Asprin, others specify)

12. Other medication:

	No	Yes
a) Beta-adrenergic blockers	□	□
b) Calcium channel blockers	□	□
c) Diuretics	□	□
d) ACE inhibitors	□	□
e) Antiarrhythmics	□	□
f) Digoxin	□	□
g) Contraceptives	□	□
h) Others	□	□