Georgian Scientists

ქართველი მეცნიერები

Vol. 4 Issue 2, 2022

https://doi.org/10.52340/gs.2022.04.02.17

The prevalence of Type 2 Diabetes among people living with HIV in Georgia

[1]Borkowska T, [1]Karkashadze E , [1]Chokoshvili O, [1]Chkhartishvili N, [1]Tsertsvadze T

[1]*Infectious Diseases, AIDS and Clinical Immunology Research Center*

Abstract

Backround: The number of people living with human immunodeficiency virus (HIV) is increasing due to improved screening, faster diagnosis, newer methods, availability and acceptance of treatment, but the prevalence of non-communicable diseases, particularly metabolic disorders, has grown among HIV infected patients.The aim of the study was to calculate the prevalence of T2D among people living with HIV in Georgia and find the association between diabetes and other comorbidities to fill up knowledge gap.

Materials and methods: We have conducted a prospective cohort study among PLWH receiving care at the Infectious Diseases, AIDS and Clinical Immunology Research Center in Tbilisi, Georgia. The study included HIV positive adults (age ≥ 18 years) diagnosed in 2012-2018. Participants were followed-up from AIDS diagnosis till the 1st of October 2021. American Diabetes Association (ADA) guidelines were used to define hyperglycemia and diabetes.

Results : In total cohort 4.47% had prediabetes and 2.65% Type 2 diabetes. Our research demonstrates that the prevalence of hyperglycemia increases by the age. In total 171 (5.87%) participants had TB . Hyperglycemia and TB together was detected in 48.5% (83) of all TB patients. Relative risk (RR) of TB was 0.94 (95% CI : 0.85-1.56) . 32 participants had CKD, 50% (p=0.08) had hyperglycemia. CVD was detected in 92 participants, 44.6% (p=0.07) was hyperglycemic.16 patients had a stroke, from which 11 (68.8%) had hyperglycemia. The RR of stroke =1.8 (95% CI : 1.45-4.76) . 550 (18.9%) patients had high total cholesterol and LDL level, 195 (35%) had hyperglycemia .

Conclusions: Prevention or early detection of T2D and timely management of metabolic disturbance, reduces risk of morbidity and mortality during HIV. Screening and management of hyperglycemia should be part of the routine HIV clinical services.

Keywords : *Type 2 diabetes, Hyperglycemia, HIV, Prevalence, Georgia*

Introduction

The number of people living with human immunodeficiency virus (HIV) is increasing due to improved screening, faster diagnosis, newer methods, availability and acceptance of treatment[1, 2], but the prevalence of non-communicable diseases, particularly metabolic disorders, has grown among HIV infected patients[1,3-6].

A lot of studies have found that HIV infection and ART (antiretroviral treatment) are increasing insulin resistance, which leads Type 2 diabetes (T2D)[7-10]. Risk factors of T2D are well known in the general population, but HIV and ART are adding additional risk factors. Many factors influence the development of hyperglycemia and T2D during HIV infection, including the duration of the infection, systematic inflammation, the degree of immunosuppression, ARV (antiretroviral) medications, length of ART and coinfections [7-15]. Based on studies the prevalence of T2D ranges from 2% to 14% [1].

After ART has appeared the number of metabolic complications during HIV has increased[6, 16-21]. The researchers thought, that metabolic complications were caused by nucleoside reverse transcriptase inhibitors (NRTI), because of mitochondrial toxicities. Other studies connected metabolic complications to protease inhibitors (PI). At the end researches suggested, that PIs and NRTIs have overlapping effect and they can induce insulin resistance (IR) and diabetes [8, 12, 18]. Old age, weight gain, family history of diabetes are risk factors for development of diabetes during PI treatment [11].

Insulin resistance during PI treatment is increased via GLUT4 dependent [8, 11] and independent mechanisms [8, 12]. PIs interfere GLUT4 translocation from the cytosol of the cell to the cell's surface. Also, they altert adipogenic proteins and inhibit adipocyte differentiation [8].

Pancreatic beta-cell lipotoxicity and lipodystrophy during ART, might be reason of glucose level elevation. Beta-cell function and insulin secretion is decreased by 25%–50% after PI treatment initiation[8]. When PIs are discontinued hyperglycemia resolves [11].

CVD (cardiovascular disease), CKD (chronic kidney disease) and metabolic disturbance have been linked to HIV and ARV medications [5,6,10].

In the general population The Framingham Risk Score (FRS) is a widely used tool to assess cardiovascular risk. It is used to estimate 10 years, CVD risk to the individual. Although its applicability to HIV patients is debatable. Unlike metabolic syndrome FRS is age dependent and takes in account cigarette smoking, LDL and total cholesterol concentrations. FRS divides individuals as low risk <10%, moderate risk 10-20% and high risk >20% of CVD[22, 23]. FRS estimates that 1/3-1/4 of HIV infected adults are risk of CVD, but some authros are thinking, that it is underestimated[22-24]. Hyperglycemia is known to be a risk factor of CVD. Poor glycemic control is connected to microvascular and macrovascular disease[25]. Stettler et al.

conducted a study in 2006 and showed, that the risk of macrovascular disease was significantly decreased by improving glycemic control[26].

The mechanism of vascular damage during hyperglycemia is unknown, but scientists support the idea, that it is caused by oxidative stress. Oxidative stress is the reason for micro and macrovascular complications during T2D[25]. Gerich et al. suggest that inflammation, vasoconstriction and thrombosis are caused by oxidative stress and protein kinase C activation, which are induced by hyperglycemia[27].

One of the most frequent complication of HIV is a CKD. It ranges from 3.5 to 48.5%. HIV-associated nephropathy (HIVAN) is more common in young African adults, while HIV-immune complex disease (HIV-ICD) is more common in Europeans[28]. On the other hand hyperglycemia and diabetes mellitus is a main cause of CKD, which leads to kidney failure. Studies have shown, that one third of CKD patients have diabetes, predominantly T2D[29].

Since 20th century, researchers have tried to find a link between T2D and Tuberculosis (TB). They were unable to distinguish whether T2D cause TB or vice versa. Some experts were discussing merging epidemics of TB and T2D [30]. People with diabetes and hyperglycemia are more likely to develop TB, compared to non-diabetic cohort, due to increased susceptibility to infections[30-33]. They have 2.44 to 8.33 folds increased risk of TB compared to people without diabetes mellitus (DM)[32]. According to several studies, people with hyperglycemia are more prone to acquire multiresistant TB. The risk of complications, such as treatment failures and death are higher in people with diabetes mellitus. Furthermore, treatment of TB, might affect glycemic control negatively[30-33].

Patients should be checked annually, because of higher prevalence of hyperglycemia and T2D during HIV. Prevention or early detection of T2D and timely management of metabolic disturbance, reduce risk of morbidity and mortality during HIV [5, 7, 8, 17, 19, 34, 35].

The prevalence of T2D in PLWH is unknown in Georgia. The aim of the study was to calculate the prevalence of T2D among people living with HIV in Georgia and find the association between diabetes and other comorbidities to fill up knowledge gap.

Material and methods

We have conducted a prospective cohort study among PLWH receiving care at the Infectious Diseases, AIDS and Clinical Immunology Research Center in Tbilisi, Georgia (IDACIRC). The study included HIV positive adults (age ≥ 18 years) diagnosed in 2012-2018 in IDACIRC. Every patient, who died or was lost within 6 months during follow-up were excluded from statistical analysis. Participants were followed-up from AIDS diagnosis till the 1st of October 2021. The total number of the study cohort was 2914.
The national AIDS health information system (AIDSHIS), a secure web-based database that collects data on all confirmed HIV cases, was used to retrieve all data, including demographic, clinical, and laboratory information.

National HIV guidelines recommended screening for glycemia at the beginning of HIV Diagnosis and then annually. American Diabetes Association (ADA) guidelines were used to define hyperglycemia and diabetes. In particular a fasting blood sugar level less than 100 mg/dl (5.6 mmol/L) is normal. A fasting blood sugar is considered as prediabetes if glucose level is from 100 to 125 mg/dl (5.6 to 6.9 mmol/L). If it's 126 mg/dl (7 mmol/L) or higher on two separate tests, patient has diabetes. A Postprandial blood sugar level less than 140 mg/dl (7.8 mmol/L) is normal. A reading between 140 and 199 mg/dl (7.8 mmol/L and 11.0 mmol/L) indicates prediabetes. Blood glucose more than 200 mg/dl (11.1 mmol/L) after two hours indicates diabetes[36].

Every single patient who had hyperglycemia even once was referred to endocrinologist for further diagnostics of diabetes. Participants were enrolled in the prospective study after giving an informed consent. Additional diagnostic tests, In particular, Oral glucose tolerance test (OGTT) with 75g glucose, glycated hemoglobin, HOMA Index, Lipid panel were conducted among the participants. We have estimated the prevalence of Diabetes, TB, CVD, CKD and stroke. The association between hyperglycemia and TB, CVD, CKD, stroke has been calculated.

For statistical analysis we have performed Descriptive and Bivariate analysis, using SAS 9.2 software (SAS Institute Inc., Cary, NC, USA).

Ethical approval was obtained from the ethics committee of at Infectious Diseases, AIDS and Clinical Immunology Research center (N 20-006).

Results and Discussion

Our original sample consisted of 2914 HIV patients, the majority of the participants were male 2204 (75.6%). The majority of the patients represented age categories of 30-39 years old (31.3%) and 40-49 years old (29.7%). The median age was 52 (IQR=22-80). 11 (0.4%) Patients did not enroll in the study due to Covid-19 pandemic related situation.7.4% of the participants were lost to follow up. For the period from 2012 to 2021 153 (5.2%) died. Hyperglycemia was detected in 381(13.1%) HIV patients. The detailed description of the sample characteristics is provided in the tables 1 and 2.

Table 1. Sample characteristics of people living with HIV (n=2914), Georgia, 2021

Variable	Total N (%)	Male	Female
Gender	2914 (100%)	2204 (75.6%)	710 (24.4%)
Hyperglycemia	381 (13.1 %)	326 (85.6 %)	55 (14.4 %)
Refused to participate for further examinations	11 (0.4 %)	9 (0.4%)	2 (0.3%)
Loss to follow up (2012-2021 years)	215 (7.4%)	183 (8.3%)	32 (4.5%)
Died during follow up (2012-2021 years)	153 (5.2%)	130 (5.9%)	22 (3.1%)
Performed diagnostic tests (OGTT Homa Index Lipid panel Glycated hemoglobin)	155 (5.3%)	145 (6.6%)	10 (1.4%)

Table 2. The prevalence of hyperglycemia by the age and gender among people living with HIV (n=2914), Georgia, 2021

Variable	Total N (%)	Normoglycemia	Hyperglycemia
Gender	2914 (100%)	2533 (86.9%)	381 (13.1 %)
Male	2204 (75.6%)	1878 (85.2%)	326 (14.8 %)
Female	710 (24.4%)	655 (92.25%)	55 (7.75 %)
Age (years)	2914 (100%)	2533 (86.9%)	381 (13.1 %)
19-29	501 (17.2 %)	496 (99.9%)	5 (0.1%)
30-39	913 (31.3%)	856 (94.7%)	48 (5.3%)
40-49	865 (29.7%)	753 (87.0%)	112 (13.0%)
50-64	577 (19.8%)	395(68.5%)	182 (31.5%)
>65	58 (2.0%)	24 (41.4%)	34 (58.6%)

The prevalence of hyperglycemia, was increasing with the age: 5 (1.31%) in the age group of 19-29 years, 48 (12.6%) in 30-39 years, 112 (29.4%) in 40-49 years, 182 (47.8%) in 50-64 years and 34 (8.9%) in older than 65 years (p value < 0.0001) (Table 3).

Table 3. The prevalence and distribution of hyperglycemia by age among people living with HIV (n=2914), Georgia, 2021

Prevalence of Hyperglycemia by age	Total sample (N=381) 13.1 %					P value	Median (IQR)
	19-29	30-39	40-49	50-64	>65		52 (22- 80)
	5 (1.31%)	48 (12.6%)	112 (29.4%)	182 (47.8%)	34 (8.9%)	<0.0001	

Additional tests (OGTT, Homa Index, Lipid panel, Glycated hemoglobin) hava been conducted in 155 (5.3%) study participants. From 2914 HIV infected persons 4.47% (95% CI : 3.77 - 5.27) had metabolic syndrome and 2.65% (95% CI: 2.11 - 3.28) T2D. From 381 hyperglycemic participants 33.7% (29.0 – 38.5) had metabolic syndrome and 19.9% (16.0 – 24.3) T2D. From examined cohort (N=155) metabolic syndrome was detected in 82.2% (95% CI: 76.2 – 88.2) and T2D in 48.4 % (95% CI: 40.5 – 56.2) cases (Table 4).

Table 4. The prevalence of type 2 diabetes and metabolic syndrome among people living with HIV (n=2914), Georgia, 2021

Variable	Metabolic syndrome (N= 130)	95 % Confidence Interval (CI)	Type 2 diabetes (N= 65)	95 % Confidence Interval (CI)
Total (N = 2194)	4.47%	3.77 - 5.27	2.65%	2.11 - 3.28
Hyperglycemia (N= 381)	33.7%	29.0 – 38.5	19.9 %	16.0 – 24.3
Examined Cohort (N=155) (OGTT Homa Index Lipid panel Glycated hemoglobin)	82.2%	76.2 – 88.2	48.4 %	40.5 – 56.2

In total 171 (5.87%) participants had TB. Hyperglycemia and TB together was detected in 48.5% (83) of all TB patients. Relative risk (RR) of TB was 0.94 (95% CI: 0.85-1.56). 32 participants had CKD, 50% (p=0.08) had hyperglycemia. CVD was detected in 92 participants, 44.6% (p=0.07) was hyperglycemic.16 patients had a stroke, from which 11 (68.8%) had hyperglycemia. The RR of stroke =1.8 (95% CI: 1.45-4.76). 550 (18.9%) patients had high total cholesterol and LDL level, 195 (35%) had hyperglycemia.

In our study the prevalence of hyperglycemia was significantly higher in male HIV infected participants, compared to the female HIV infected persons. Similar results have been reported from china (Shen et al. 2016)[1] in contrast to Spanish study (Alvaro-Meca et al. 2016). Spanish study outlined, that hyperglycemia was more prevalent in female HIV patients [37].

Our research demonstrates that the prevalence of hyperglycemia increases by the age. Results are not surprising, because, similar results have been reported in other studies about PLWH[5, 15, 38, 39]and general population[36]. Factors such as a family history of diabetes, weight gain, obesity and Insulin resistance can lead increased blood glucose levels[11]. Furthermore, some antiretroviral drugs, such as PI's and NRTI's were related to the higher risk of T2D. Longer ART exposure was shown to be responsible for increased risk of hyperglycemia and diabetes mellitus [1, 3, 4, 11]. In addition, there are a lot of discussions whether or not HIV infection alone can promote to the development of T2D. For example, a study of 2009-2012 years in China, conducted among newly diagnosed HIV patients who were not taking antiretroviral drugs, found a significant association between HIV and T2D, suggesting that hyperglycemia in HIV patients might be explained by not only ART use, but by HIV infection itself [40]. Unfortunately, association between ART and diabetes or hyperglycemia could not be examined in our study as all the patients diagnosed with HIV in our cohort received ART immediately after the diagnosis.

Our study found out that the prevalence of T2D in total cohort was 2.65%. Similar results have been reported from Denmark (Rasmussen et al. 2012, Worm et al .2009)[41, 42] in contrast to researches in China and the USA, where prevalence of T2D was 9.7% and 10.3% respectively[1, 5]. It should be taken into account that study cohort age was young (about 40 years old). T2D is more common in people above 40 years old, so theoretically it's possible, that young participants might decrease the prevalence of diabetes in the total cohort. Age distribution of hyperglycemia proved the same as it was the highest in people aged 40-65+. A similar association between increasing age and prevalence of T2D among PLWH found in many other studies[5, 38, 39].

Our study found that the prevalence of tuberculosis was 5.87% among people living with HIV. Based on our results the prevalence of TB with and without hyperglycemia did not differ significantly. Similar results have been found in UK by Pealing et al [43]. Other studies revealed different results and showed, that diabetes and hyperglycemia were significantly associated with increased risk of TB[30, 32, 33]. According to, the study in Sounth Africa by Oni et al TB in hyperglycemic patients were 2.4 fold higher, compared to

normoglycemic cohort[33]. Other studies suggested, that hyperglycemia is associated with higher mortality rates in TB patients[19, 44, 45].

In our research, the most common complication was dyslipidemia. We found out that 1/5 of our cohort had a high cholesterol level. As we mentioned HIV and ART are key factors in disease development[8, 16, 23, 34, 46-48]. In addition, well know factors such as an unhealthy diet, low physical activity and cigarette smoking increase risk of dyslipidemia. If dyslipidemia is untreated, it leads to serious health complications and CVD.

CVD was detected in 92 participants, 44.6% had hyperglycemia. Based on RR normoglycemic and hyperglycemic cohort did not differ significantly. It might be explained by the fact, that our general cohort was young and the risk of CVD is increasing with the age. The Higher prevalence of CVD was reported in general population Georgia, compared to people living with HIV (15.3 vs 3.1 respectively).

Our study demonstrated that the risk of stroke was 2.2 times higher in hyperglicemic cohort, compared to people with normoglycemia. Similar results have been reported from another study By Michael D Hill in 2014[49] . Nearly 30-40% of acute ischemic stroke patients have hyperglycemia. It has been reported, that hyperglycemia increases mortality rate significantly in patients with acute ischemic stroke[50].

In our research 32 participants had CDK and half of them had hyperglycemia. It is well known, that diabetes damages kidneys and causes diabetic nephropathy.Diabetic nephropathy is a major cause of CKD and renal failure[29, 51]. Additional risk factors of CKD are HIV and ART by itself[28, 29, 51, 52]. Based on our results the rate of CKD in hyperglycemic and normoglycemic cohort, did not differ significantly.

Hyperglycemia and other non communicable diseases should be monitored annually among people living with HIV to decrease morbidity and mortality rate. Prevention and early detection of noncommunicable diseases among PLWH will increase life expectancy and improve quality of life.

Conclusions

Noncommunicable diseases among PLWH, in particular hyperglycemia and T2D is a growing problem around the world. Our research addressed an issue. The prevalence of T2D and metabolic syndroime has never been calculated in Georgia before. We found out that the prevalence of T2D is 2.65% and is not higher, than prevalence in general population in Georgia. We think that further studies are needed to clarify an issue. Prevention or early detection of T2D and timely management of metabolic disturbance reduces risk of morbidity and mortality during HIV. Screening and management of hyperglycemia should be part of the routine HIV clinical services.

References

1. Shen Y, Wang Z, Liu L, Zhang R, Zheng Y and Lu H. Prevalence of hyperglycemia among adults with newly diagnosed HIV/AIDS in China. *BMC Infectious Diseases*. 2013; 13: 79.
2. Wandeler G, Johnson LF and Egger M. Trends in life expectancy of HIV-positive adults on antiretroviral therapy across the globe: comparisons with general population. *Current opinion in HIV and AIDS*. 2016; 11: 492-500.
3. Brown TT, Tassiopoulos K, Bosch RJ, Shikuma C and McComsey GA. Association between systemic inflammation and incident diabetes in HIV-infected patients after initiation of antiretroviral therapy. *Diabetes care*. 2010; 33: 2244-9.
4. Coelho AR, Moreira FA, Santos AC, et al. Diabetes mellitus in HIV-infected patients: fasting glucose, A1c, or oral glucose tolerance test – which method to choose for the diagnosis? *BMC Infectious Diseases*. 2018; 18.
5. Hernandez-Romieu AC, Garg S, Rosenberg ES, Thompson-Paul AM and Skarbinski J. Is diabetes prevalence higher among HIV-infected individuals compared with the general population? Evidence from MMP and NHANES 2009–2010. *BMJ Open Diabetes Research & Care*. 2017; 5.
6. Pelchen-Matthews A, Ryom L, Borges Á H, et al. Aging and the evolution of comorbidities among HIV-positive individuals in a European cohort. *AIDS (London, England)*. 2018; 32: 2405-16.
7. Duncan AD, Goff LM and Peters BS. Type 2 diabetes prevalence and its risk factors in HIV: A cross-sectional study. *PLoS ONE*. 2018; 13.
8. Husain NE, Noor SK, Elmadhoun WM, et al. Diabetes, metabolic syndrome and dyslipidemia in people living with HIV in Africa: re-emerging challenges not to be forgotten. *HIV/AIDS (Auckland, NZ)*. 2017; 9: 193-202.
9. Suligoi B, Virdone S, Taborelli M, et al. Excess mortality related to circulatory system diseases and diabetes mellitus among Italian AIDS patients vs. non-AIDS population: a population-based cohort study using the multiple causes-of-death approach. *BMC Infectious Diseases*. 2018; 18: 428.
10. Teeraananchai S, Kerr SJ, Amin J, Ruxrungtham K and Law MG. Life expectancy of HIV-positive people after starting combination antiretroviral therapy: a meta-analysis. *HIV medicine*. 2017; 18: 256-66.
11. Kalra S, Kalra B, Agrawal N and Unnikrishnan A. Understanding diabetes in patients with HIV/AIDS. *Diabetology & Metabolic Syndrome*. 2011; 3: 2.
12. Kumar S and Samaras K. The Impact of Weight Gain During HIV Treatment on Risk of Pre-diabetes, Diabetes Mellitus, Cardiovascular Disease, and Mortality. *Frontiers in endocrinology*. 2018; 9: 705.
13. Saeedi P, Petersohn I, Salpea P, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9(th) edition. *Diabetes research and clinical practice*. 2019; 157: 107843.

14. Spollett GR. Hyperglycemia in HIV/AIDS. *Diabetes Spectrum*. 2006; 19: 163-6.
15. Tien PC, Schneider MF, Cox C, et al. Association of HIV infection with incident diabetes mellitus: impact of using hemoglobin A1C as a criterion for diabetes. *Journal of acquired immune deficiency syndromes (1999)*. 2012; 61: 334-40.
16. Fleischman A, Johnsen S, Systrom DM, et al. Effects of a nucleoside reverse transcriptase inhibitor, stavudine, on glucose disposal and mitochondrial function in muscle of healthy adults. *American journal of physiology Endocrinology and metabolism*. 2007; 292: E1666-73.
17. Haguihara T, Silva MDO, Rebouças MC, Martins Netto E and Brites C. Factors associated with mortality in HIV patients failing antiretroviral therapy, in Salvador, Brazil. *The Brazilian journal of infectious diseases : an official publication of the Brazilian Society of Infectious Diseases*. 2019; 23: 160-3.
18. Karamchand S, Leisegang R, Schomaker M, et al. Risk Factors for Incident Diabetes in a Cohort Taking First-Line Nonnucleoside Reverse Transcriptase Inhibitor-Based Antiretroviral Therapy. *Medicine*. 2016; 95.
19. Kyaw NTT, Satyanarayana S, Oo HN, et al. Hyperglycemia and Risk of All-cause Mortality Among People Living With HIV With and Without Tuberculosis Disease in Myanmar (2011–2017). *Open Forum Infectious Diseases*. 2019; 6.
20. Patel P, Rose CE, Collins PY, et al. Noncommunicable diseases among HIV-infected persons in low-income and middle-income countries: a systematic review and meta-analysis. *AIDS (London, England)*. 2018; 32 Suppl 1: S5-s20.
21. Rajpal A, Rahimi L and Ismail-Beigi F. Factors leading to high morbidity and mortality of COVID-19 in patients with type 2 diabetes. *Journal of diabetes*. 2020; 12: 895-908.
22. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation*. 2002; 106: 3143-421.
23. Nix LM and Tien PC. Metabolic syndrome, diabetes, and cardiovascular risk in HIV. *Current HIV/AIDS reports*. 2014; 11: 271-8.
24. Law MG, Friis-Møller N, El-Sadr WM, et al. The use of the Framingham equation to predict myocardial infarctions in HIV-infected patients: comparison with observed events in the D:A:D Study. *HIV medicine*. 2006; 7: 218-30.
25. Davidson JA and Parkin CG. Is hyperglycemia a causal factor in cardiovascular disease? Does proving this relationship really matter? Yes. *Diabetes care*. 2009; 32 Suppl 2: S331-3.
26. Stettler C, Allemann S, Jüni P, et al. Glycemic control and macrovascular disease in types 1 and 2 diabetes mellitus: Meta-analysis of randomized trials. *American heart journal*. 2006; 152: 27-38.
27. Gerich JE. Clinical significance, pathogenesis, and management of postprandial hyperglycemia. *Archives of internal medicine*. 2003; 163: 1306-16.
28. Naicker S, Rahmanian S and Kopp JB. HIV and chronic kidney disease. *Clinical nephrology*. 2015; 83: 32-8.

29. Sampanis C. Management of hyperglycemia in patients with diabetes mellitus and chronic renal failure. *Hippokratia*. 2008; 12: 22-7.
30. Jeon CY and Murray MB. Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. *PLoS medicine*. 2008; 5: e152.
31. Casqueiro J, Casqueiro J and Alves C. Infections in patients with diabetes mellitus: A review of pathogenesis. *Indian Journal of Endocrinology and Metabolism*. 2012; 16: S27-36.
32. Dooley KE and Chaisson RE. Tuberculosis and diabetes mellitus: convergence of two epidemics. *The Lancet Infectious diseases*. 2009; 9: 737-46.
33. Oni T, Berkowitz N, Kubjane M, Goliath R, Levitt NS and Wilkinson RJ. Trilateral overlap of tuberculosis, diabetes and HIV-1 in a high-burden African setting: implications for TB control. *The European respiratory journal*. 2017; 50.
34. Achwoka D, Waruru A, Chen TH, et al. Noncommunicable disease burden among HIV patients in care: a national retrospective longitudinal analysis of HIV-treatment outcomes in Kenya, 2003-2013. *BMC Public Health*. 2019; 19.
35. Han JH, Crane HM, Bellamy SL, Frank I, Cardillo S and Bisson GP. HIV infection and glycemic response to newly initiated diabetic medical therapy. *AIDS (London, England)*. 2012; 26: 2087-95.
36. ADA ADA. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2021. *Diabetes care*. 2021; 44: S15-s33.
37. Alvaro-Meca A, Jiménez-Garcia R, Jimenez-Trujillo I, et al. Fifteen-Year Trends in the Prevalence of Diabetes among Hospitalized HIV-Infected Patients in Spain (1997-2012). *PLoS ONE*. 2016; 11: e0161953.
38. Capeau J, Bouteloup V, Katlama C, et al. Ten-year diabetes incidence in 1046 HIV-infected patients started on a combination antiretroviral treatment. *AIDS (London, England)*. 2012; 26: 303-14.
39. Tripathi A, Liese AD, Jerrell JM, et al. Incidence of diabetes mellitus in a population-based cohort of HIV-infected and non-HIV-infected persons: the impact of clinical and therapeutic factors over time. *Diabetic medicine : a journal of the British Diabetic Association*. 2014; 31: 1185-93.
40. Wada N, Jacobson LP, Cohen M, French A, Phair J and Muñoz A. Cause-specific mortality among HIV-infected individuals, by CD4(+) cell count at HAART initiation, compared with HIV-uninfected individuals. *AIDS (London, England)*. 2014; 28: 257-65.
41. Rasmussen LD, Mathiesen ER, Kronborg G, Pedersen C, Gerstoft J and Obel N. Risk of diabetes mellitus in persons with and without HIV: a Danish nationwide population-based cohort study. *PLoS ONE*. 2012; 7: e44575.
42. Worm SW, De Wit S, Weber R, et al. Diabetes mellitus, preexisting coronary heart disease, and the risk of subsequent coronary heart disease events in patients infected with human immunodeficiency virus: the Data Collection on Adverse Events of Anti-HIV Drugs (D:A:D Study). *Circulation*. 2009; 119: 805-11.

43. Pealing L, Wing K, Mathur R, Prieto-Merino D, Smeeth L and Moore DAJ. Risk of tuberculosis in patients with diabetes: population based cohort study using the UK Clinical Practice Research Datalink. *BMC Medicine*. 2015; 13: 135.
44. Chkhartishvili N, Sharvadze L, Chokoshvili O, et al. Mortality and Causes of Death Among HIV-Infected Individuals in the Country of Georgia: 1989–2012. *AIDS Research and Human Retroviruses*. 2014; 30: 560-6.
45. Moreira J, Castro R, Lamas C, Ribeiro S, Grinsztejn B and Veloso VG. Hyperglycemia during tuberculosis treatment increases morbidity and mortality in a contemporary cohort of HIV-infected patients in Rio de Janeiro, Brazil. *International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases*. 2018; 69: 11-9.
46. Friis-Møller N, Sabin CA, Weber R, et al. Combination antiretroviral therapy and the risk of myocardial infarction. *The New England journal of medicine*. 2003; 349: 1993-2003.
47. Friis-Møller N, Thiébaut R, Reiss P, et al. Predicting the risk of cardiovascular disease in HIV-infected patients: the data collection on adverse effects of anti-HIV drugs study. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology*. 2010; 17: 491-501.
48. Kruglikov IL, Shah M and Scherer PE. Obesity and diabetes as comorbidities for COVID-19: Underlying mechanisms and the role of viral-bacterial interactions. *eLife*. 2020; 9.
49. Hill MD. Stroke and diabetes mellitus. *Handbook of clinical neurology*. 2014; 126: 167-74.
50. Ergul A, Li W, Elgebaly MM, Bruno A and Fagan SC. Hyperglycemia, diabetes and stroke: focus on the cerebrovasculature. *Vascular pharmacology*. 2009; 51: 44-9.
51. Lim A. Diabetic nephropathy - complications and treatment. *International journal of nephrology and renovascular disease*. 2014; 7: 361-81.
52. Mocroft A, Lundgren JD, Ross M, et al. Development and validation of a risk score for chronic kidney disease in HIV infection using prospective cohort data from the D:A:D study. *PLoS medicine*. 2015; 12: e1001809.

ტიპი 2 შაქრიანი დიაბეტის გავრცელება აივ ინფიცირებულ პირებში, საქართველოში

თ.ბორკოვსკა[1], ე. ქარქაშაძე[1], ო.ჩოკოშვილი[1] , ნ.ჩხარტიშვილი[1], თ.ცერცვაძე[1]

[1]ინფექციური პათოლოგიის, შიდსისა და კლინიკური იმუნოლოგიის სამეცნიერო პრაქტიკული ცენტრი

აბსტრაქტი

შესავალი: ადამიანის იმუნოდეფიციტის ვირუსით (აივ) მცხოვრებთა რიცხვი იზრდება გაუმჯობესებული სკრინინგის, სწრაფი დიაგნოზის, ახალი მეთოდების, მკურნალობის ხელმისაწვდომობისა და მკურნალობის მიღების გამო. არაგადამდები დაავადებების, განსაკუთრებით მეტაბოლური დარღვევების გავრცელებამ მკვეთრად მოიმატა აივ ინფიცირებულ პაციენტებში.

კვლევის მიზანია ტიპი 2 შაქრიანი დიაბეტის გავრცელების გამოთვლა, შაქრიანი დიაბეტისა და თანმხლები დაავადებებს შორის ასოციაციის პოვნა, არსებული საკითხის ირგვლივ ცოდნის გაღრმავება.

კვლევის მეთოდები: ინფექციური პათოლოგიის, შიდსისა და კლინიკური იმუნოლოგიის სამეცნიერო პრაქტიკულ ცენტრში ჩავატარეთ პროსპექტული კოჰორტული კვლევა. კვლევაში მონაწილეობდა მოზრდილი (ასაკი≥18წელი) პირები, რომლებსაც აივ დიაგნოზი დაესვათ 2012-2018 წლებში. პაცინტებზე დაკვირვება ხორციელდებოდა 2021 წლის 1 ოქტომბრამდე. ჰიპერგლიკემიისა და შაქრიანი დიაბეტის განმარტებებისთვის გამოვიყენეთ ამერიკის დიაბეტის ასოციაციის (ADA) გაიდლაინბი.

შედეგები: მთლიან კოჰორტაში 4.47% ჰქონდა პრედიაბეტი, ხოლო 2.65% ტიპი 2 შაქრიანი დიაბეტი. ჩვენი კვლევის მიხედვით ჰიპერგლიკემიის პრევალენტობა იზრდება ასაკის მატებასთან ერთად. ჯამში 171 (5.87%) მონაწილეს ჰქონდა ტუბერკულოზი. ტუბერკულოზის მქონე 48.5% (83) ჰქონდა ჰიპერგლიკემიაც. ტუბერკულოზის RR=0.94 (95% CI: 0.85-1.56). 32 მონაწილეს CKD ჰქონდა, მათგან 50% (p=0.08) ჰიპერგლიკემიაც. CVD 92 პაციენტს დაუფიქსირდა, მათგან 44.6% (p=0.07) კი ჰიპერგლიკემია ჰქონდა.16 მონაწილეს ინსულტი განუვითარდა, მათგან 11 (68.8%) პარალელურად ჰიპერგლიკემიაც ჰქონდა. ინსულტის RR =1.8 (95% CI : 1.45-4.76) . 550 (18.9%) მონაწილეს მომატებული ჰქონდა საერთო ქოლესტერინისა და LDL კონცენტრაცია, მათგან195 (35%) ჰიპერგლიკემიაც ჰქონდა.

დასკვნა: ტიპი 2 დიაბეტის პრევენცია, ადრეული გამოვლენა და მეტაბოლური დარღვევების დროული მართვა შეამცირებს ავადობისა და სიკვდილიანობის რისკს აივ ინფექციის დროს. ჰიპერგლიკემიის სკრინინგი და მენეჯმენტი ინტერგრირებული უნდა იყოს აივ-ის რუტინული კლინიკური კვლევის პაკეტში.

საკვანძო სიტყვები: *ტიპი 2 შაქრიანი დიაბეტი, ჰიპერგლიკემია, აივ, პრევალენტობა, საქართველო*