# TreatmentUpdate 193

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## I ANTI-HIV AGENTS

### A. Elvitegravir vs. raltegravir—two-year results

Raltegravir belongs to a group of drugs called integrase inhibitors and is sold under the brand name Isentress. Raltegravir is taken twice daily with or without food. In clinical trials raltegravir is a highly effective part of combination anti-HIV therapy (commonly called ART or HAART) and is generally safe.

Elvitegravir is an experimental integrase inhibitor. It needs to be taken with another drug that can raise, or boost, levels of elvitegravir in the blood. Such boosting drugs are called pharmacokinetic enhancers and examples of these are ritonavir (Norvir) and the new drug cobicistat.

On August 27, 2012, the U.S. Food and Drug Administration (FDA) approved a combination of the following four drugs (three of which—elvitegravir, tenofovir and FTC—have anti-HIV activity) in one pill:

- elvitegravir
- cobicistat
- tenofovir (Viread)
- FTC (emtricitabine, Emtriva)

This combination of four drugs in one pill taken once daily will be sold under the brand name Stribild and has been nicknamed the Quad. The Quad needs to be taken with a meal to maximize absorption and has been tested as a first regimen in HIV-positive people. There is also another group of people, those who have previously used several regimens—the treatment-experienced—and they could also benefit

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from elvitegravir. Therefore, Gilead Sciences, the manufacturer of elvitegravir (and the Quad) is testing elvitegravir in different populations, including treatment-experienced people.

In study 145, researchers in several countries recruited and randomly assigned 712 HIV-positive volunteers to one of the following treatment groups:

- elvitegravir + a ritonavir-boosted protease inhibitor + a third drug
- raltegravir + a ritonavir-boosted protease inhibitor + a third drug

The study was double blind and placebo controlled so that neither participants nor researchers knew who received elvitegravir until the study ended.

At the start of the study, an equal proportion of participants in each group were taking ritonavir with the following protease inhibitors:

- darunavir (Prezista) – 58%
- lopinavir (in Kaletra) – 19%
- atazanavir (Reyataz) – 17%
- fosamprenavir (Telzir) – 4%
- tipranavir (Aptivus) – 2%

Participants were randomly assigned as follows:

- elvitegravir-based regimen – 354 people
- raltegravir-based regimen – 358 people

The average profile of participants at the time they entered the study was as follows:

- 82% men, 18% women
- age – 45 years
- CD4+ cell count – 220 cells
- HIV viral load – 32,000 copies/ml
- HBV co-infection – 4%
- HCV co-infection – 15%

About 60% of participants had HIV that was resistant to two or more classes of drugs.

Elvitegravir was taken at a dose of 85 mg once daily if used with atazanavir or lopinavir, otherwise it was taken at a dose of 150 mg, also once daily.

Raltegravir was taken at a standard dose of 400 mg twice daily.

The study was planned to last about two years (96 weeks) and we now present the results.

## Results

A similar proportion of participants in each group achieved a viral load less than 50 copies/ml by the 48th week of the study, as shown below:

- elvitegravir-based regimen – 59%
- raltegravir-based regimen – 58%

Virologic suppression (less than 50 copies/ml) at week 96 was as follows:

- elvitegravir-based regimen – 48%
- raltegravir-based regimen– 45%

On average, CD4+ counts increased by 200 cells two years after entering the study.

About 19% of participants in each group left the study prematurely for at least one of the following reasons:

- side effects
- not taking the study medicines as directed
- pregnancy
- death
- failing to return for clinic visits

## Side effects and complications

Side effects and complications graded as moderate to severe occurred in 68% of participants in each group. Here is the distribution of selected adverse effects:

Diarrhea
- elvitegravir – 13%
- raltegravir – 8%

Nausea
- elvitegravir – less than 1%
- raltegravir – 0%

Vomiting
- elvitegravir – less than 1%
- raltegravir – 0%

Sinus infection
- elvitegravir – 5%
- raltegravir – 4%

Chest infection
- elvitegravir – 5%
- raltegravir – 4%

Back pain
- elvitegravir – 6%
- raltegravir – 4%

Depression
- elvitegravir – 6%
- raltegravir – 6%

Thoughts of suicide
- elvitegravir – 1%
- raltegravir – 1%

Bone or joint pain
- elvitegravir –5%
- raltegravir – 3%

Rash
- elvitegravir – 0%
- raltegravir – less than 1%

### Summary

Both integrase inhibitors were generally well tolerated with similar rates of effectiveness in this heavily treatment-experienced population.

REFERENCE:

Elion R, Molina J-M, Arribas-Lopez J-R, et al. Efficacy and safety results from a randomized, double-blind, active-controlled trial of elvitegravir (once daily) vs. raltegravir (twice daily) in treatment-experienced HIV-infected patients. In: Program and abstracts of the *XIX International AIDS Conference*, 22–27 July 2012, Washington, DC. Abstract TUAB 0105.

## B. Dolutegravir vs. raltegravir

Dolutegravir is an experimental integrase inhibitor. In a study called Spring, researchers randomly assigned 822 HIV-positive volunteers who had never received potent combination anti-HIV therapy (commonly called ART or HAART) to one of the following regimens:

- dolutegravir 50 mg once daily + two nukes (nucleoside analogues)
- raltegravir 400 mg twice daily + 2 nukes

Spring is supposed to run for 96 weeks (about two years) and in this issue of *TreatmentUpdate* we have the results after one year.

### Study details

The average profile of participants at the start of the study was as follows:

- 86% men, 14% women
- age – 36 years
- CD4+ count – 360 cells
- viral load – 35,000 copies/ml
- HBV co-infection – 2%
- HCV co-infection – 10%
- 60% of participants used Truvada (tenofovir + FTC)
- 40% of participants used Kivexa (abacavir + 3TC)

### Results

After 48 weeks, the proportion of participants who had a viral load less than 50 copies/ml was as follows:

- dolutegravir – 88%
- raltegravir – 85%

The following proportions of participants had viral loads greater than 50 copies/ml at week 48 because of a lack of effectiveness:

- dolutegravir – 1%
- raltegravir – 3%

None of these differences were statistically significant.

Both integrase inhibitors caused a rapid decrease in viral load when treatment was initiated. For instance, after the first four weeks of the study, viral load in the blood fell below the 50-copy/ml mark in 70% of dolutegravir users and 65% of raltegravir users.

When the response to therapy was analysed by pre-study (baseline) viral load, the results were as follows:

Baseline viral load 100,000 copies/ml or less, the proportion with a viral load less than 50 copies/ml after one year of treatment was as follows:

- dolutegravir – 90%
- raltegravir – 89%

Baseline viral load greater than 100,000 copies/ml, the proportion with a viral load less than 50 copies/ml after one year was as follows:

- dolutegravir – 82%
- raltegravir – 75%

Here are the results when analysed by the nuke regimen that participants used in the study:

Proportion achieving a viral load less than 50 copies/ml

- Kivexa + dolultegravir – 86%
- Kivexa + raltegravir – 87%
- Truvada + dolutegravir – 89%
- Truvada + raltegravir – 85%

Rates of virologic failure (having a viral load greater than 50 copies/ml after week 24) were as follows:

- dolutegravir – 5%
- raltegravir – 7%

More than 80% of cases of virologic failure had viral loads between 50 and 400 copies/ml.

## Side effects and complications

Common side effects were as follows:

Nausea
- dolutegravir – 14%
- raltegravir – 13%

Headache
- dolutegravir – 12%
- raltegravir – 12%

Runny nose
- dolutegravir – 11%
- raltegravir – 12%

Diarrhea
- dolutegravir – 11%
- raltegravir – 11%

Dizziness
- dolutegravir – 6%
- raltegravir – 6%

Chest infections
- dolutegravir – 6%
- raltegravir – 6%

Fever
- dolutegravir – 5%
- raltegravir – 5%

Fatigue
- dolutegravir – 5%
- raltegravir – 4%

Anxiety
- dolutegravir – 3%
- raltegravir – 5%

Depression
- dolutegravir – 5%
- raltegravir – 3%

Severe side effects were distributed as follows:

- dolutegravir – 3% (including headache, dizziness, "feeling abnormal," irregular heartbeats)
- raltegravir – 5% (including nausea, stomach pain, rash, fatigue, elevated levels of liver and pancreatic enzymes in the blood)

Despite these results, only 2% of participants in each group left the study because of these or other symptoms.

## Lab test results

No significant changes in creatinine occurred. Less than 5% of participants in each group had elevated levels of liver or other enzymes, suggestive of ongoing organ injury.

Changes in levels of lipids—cholesterol and triglycerides—in the blood were generally minimal in this study.

## Focus on the kidneys

Neither dolutegravir nor raltegravir appeared to cause kidney dysfunction.

## Summary

After one year, a regimen based on either dolutegravir or raltegravir seemed equally effective and safe as a first-line therapy for HIV-positive people.

REFERENCE:

Raffi F, Rachlis A, Stellbrink H-J, et al. Once-daily dolutegravir (DTG: S/GSK 1349572) is non-inferior to raltegravir in antiretroviral naïve adults. 48-week results from Spring-2 (ING113086). In: Program and abstracts of the *XIX International AIDS Conference*, 22–27 July 2012, Washington, DC. Abstract THLBB04.

## C. Switching to rilpivirine

Rilpivirine (Edurant) is an anti-HIV drug called a non-nuke that is generally better tolerated than its chemical cousin efavirenz (Sustiva and in Atripla). Rilpivirine, together with the following drugs, is sold in one pill called Complera:

- tenofovir (Viread)
- FTC (emtricitabine, Emtriva)

Doctors in the U.S. conducted a study called Spirit, whereby HIV-positive volunteers who were already using a regimen based on a protease inhibitor boosted with ritonavir (Norvir) were randomly assigned to one of the following treatment groups:

- continue with their existing regimen
- switch to Complera

Six months after the study started, statistical analysis found that Complera was roughly equivalent in effectiveness to a ritonavir-boosted regimen.

### Study details

Researchers in the U.S. and a few other countries randomly assigned 476 ART users in a 2:1 ratio to the following:

- Complera
- continue with their existing regimen

The average profile of participants at the start of the study was as follows:

- 88% men, 12% women
- age – 43 years
- duration on ART – three years
- CD4+ count – 580 cells
- viral load – 50 copies/ml

Commonly used drugs at the start of the study included the following:

- Truvada (tenofovir + FTC)
- Kivexa (abacavir + 3TC)
- atazanavir (Reyataz)
- lopinavir (in Kaletra)
- darunavir (Prezista)

### Results – After 24 weeks

The proportion of participants whose viral load was less than 50 copies/ml at week 24 of the study was as follows:

- Complera – 94%
- ritonavir-boosted protease inhibitor regimen – 90%

Changes in CD4+ cell counts were as follows:

- Complera – an increase of 20 CD4+ cells
- ritonavir-based protease inhibitor regimen – an increase of 32 CD4+ cells

These differences in viral load and CD4+ cell counts were not statistically significant. Therefore, the Spirit analysis found that switching patients from a ritonavir-boosted regimen to Complera was roughly equivalent in effectiveness to maintaining them on a ritonavir-boosted regimen. The technical statistical term for this is "non-inferior."

### Mutations

HIV can develop a change, or mutation, in its genetic makeup called K103N when exposed to insufficient levels of non-nukes such as nevirapine (Viramune), efavirenz and delavirdine (Rescriptor). This mutation makes it easier for HIV to escape the effects of non-nukes, including rilpivirine. However, in the present study, among the 17 participants (5%) who had this mutation and who received rilpivirine, all were able to keep their viral loads suppressed.

### Complications and side effects

Severe or life-threatening adverse events were distributed as follows:

- Complera – 5%
- ritonavir-boosted PI regimen – 7%

Unfortunately, researchers did not present a detailed list of specific adverse events that occurred.

Severe or life-threatening changes in lab tests were distributed as follows:

- Complera – 6%
- ritonavir-boosted PI regimen – 11%

These included elevated levels of the following proteins in the blood:

- enzymes – creatine kinase and AST
- waste product – bilirubin

### Changes in lipid levels

Generally, participants who switched to Complera had significant decreases in the following fatty substances in their blood:

- total cholesterol
- LDL-cholesterol (so-called bad cholesterol)
- triglycerides

These changes were statistically significant.

Moreover, the change in the ratio of total cholesterol to HDL-cholesterol (so-called good cholesterol) among participants was generally favourable among those who received Complera. In theory, these changes should reduce a person's chances of a heart attack in the future.

### Changes in kidney health

The kidneys filter blood, sending waste into urine and returning nutrients and other vital substances back to the blood.

A relatively simple way of assessing kidney health is to conduct blood and urine tests and use these to estimate the rate at which the kidneys are able to filter wastes. This is called the estimated glomerular filtration rate (eGFR). Healthy kidneys should have an eGFR greater than 90. In the present study, the eGFR fell very slightly from 109 to 105 among Complera users and remained steady at 109 among people who continued to use ritonavir-boosted regimens.

### Summary

Switching particpants from a ritonavir-based PI regimen that contained ritonavir to Complera was roughly equal in effectiveness. Moreover, favourable changes in cholesterol and other lipids occurred among Complera users.

REFERENCE:

Palella F, Tebas P, Gazzard B, et al. Spirit study: Switching to emtricitabline/rilpivirine/tenofovir DF single tablet regimen from a ritonavir-boosted protease inhibitor and two nucleoside reverse transcriptase inhibitors maintains HIV suppression and improves serum lipids in HIV-1 infected subjects at week 24. In: Program and abstracts of the *14th International Workshop on Co-morbidities and Adverse Drug Reactions in HIV*, 19–21 July, 2012, Washington DC. Abstract 018.

## D. Attempts at a cure

Several years ago, researchers in Berlin announced that they were able to cure an HIV-positive person of this infection. The cure required intensive bouts of chemotherapy and radiation, as well as stem cell transplants from a donor with a rare mutation conferring resistance to HIV infection. As a result, Timothy Brown, the patient who received these therapies, was very weak for several years and is now somewhat disabled, though he is cured of HIV. Other researchers have repeated the protocol used by the Berlin doctors but so far no one else has been cured and several patients have died.

For background information on these experiments, please see the following CATIE resources:

http://www.catie.ca/en/catienews/2010-12-21/hints-cure-future-stem-cell-transplants-and-hiv

http://www.catie.ca/en/catienews/2011-09-27/gene-therapy-hiv-outcomes-recent-experiment

Researchers in Boston at the Dana-Farber Cancer Institute and Harvard University have been collaborating on another experiment aimed at repeating the success of the Berlin researchers without the grueling and highly dangerous chemotherapy and radiation exposure and also without using stem cell transplants from donors who can greatly resist HIV infection. Such donors have a rare mutation whereby a co-receptor needed by HIV is missing. Scientists call such a mutation "delta-32."

### Cancer

The research team enrolled two HIV-positive patients who were taking potent combination anti-HIV therapy (commonly called ART or HAART) and who had developed extensive cancers (lymphoma) of their immune systems; their chances of surviving these cancers were slim. Despite initial treatment with chemotherapy, the cancers had returned.

The men were treated with low-dose chemotherapy (not radiation) and were given stem cell transplants. These stem cells did not have any enhanced ability to resist HIV infection. In other words, they did not have the delta 32 mutation that the Berlin team used in its experiment. In addition, the Boston patients received immunosuppressive drugs—so-called transplant drugs—to allow the transplanted stem cells to survive attacks by the host immune system by partially weakening their immune system. These immunosuppressive drugs included the following:

- prednisone
- sirolimus
- tacrolimus

### Results

Nearly four years since their stem cell transplants the men are still alive. Moreover, HIV cannot be found in their blood samples or in cells of the immune system found in the blood. Levels of antibodies to HIV have greatly decreased.

It is important to note that the men remain on ART.

Researchers have not yet been able to extract small samples of lymph nodes or lymph tissue for analysis because the men are still relatively weak—both physically and immunologically—from all of the medical procedures they have undergone. So while HIV is absent from the blood, this virus may still be present in remote lymph nodes or tissues. The only way to confirm whether the men have been cured would be if they stopped taking ART and invasive procedures to extract samples of tissues from deep within their bodies were performed and such samples were analysed.

The Boston experiment, as well as other similar experiments being done by researchers in the U.S. and Western Europe, should be seen as works in progress. They will be closely watched for further developments. In the meantime, at least the two men in the Boston study have been cured of cancer.

These experiments with stem cell transplants and chemotherapy and subsequent transplant drugs are dangerous and will not be done on a large scale because among HIV-negative cancer patients such procedures carry a death rate of about 15%. No one is certain about the death rate for HIV-positive people, but it is likely to be at least as high.

REFERENCE:

Henrich TJ, Sciaranghella G, Li JZ, et al. Long-term reduction in peripheral blood HIV-1 reservoirs following reduced-intensity conditioning allogeneic stem cell transplantation in two HIV-positive individuals. In: Program and abstracts of the *XIX International AIDS Conference*, 22–27 July 2012, Washington, DC. Abstract THAA0101.

# II COMPLICATIONS AND SIDE EFFECTS

## A. Interleukin-6 and cancer risk

Under certain situations, such as the very early stages of an infection (called an acute infection), the immune system produces chemical signals, or cytokines, to help the body cope with this infection. One such cytokine is interleukin-6 (IL-6). During the acute stage of an infection, relatively high levels of IL-6 are produced and this, together with other cytokines, helps to activate T-cells, increase the number of antibody-producing B-cells and stimulate the release of hormones. Such a response during an acute infection is likely useful. However, prolonged production of relatively high levels of IL-6 may weaken the immune system over the long-term. This weakness can occur because higher-than-normal levels of IL-6 can cause the premature death of immune cells, increase the susceptibility of the liver to injury and raise the risk for cardiovascular disease. Some studies in people have found a link between an elevated level of IL-6 and an increased risk for the growth of tumours.

Chronically high levels of IL-6 might also play a role in weakening the immune systems of HIV-positive people. To investigate this possibility, researchers with the Insight Research Network, which links doctors and scientists across North America, Western Europe and Australia, reviewed information in their database. Specifically, they focused on 5,000 HIV-positive people who had been monitored for several years as part of clinical trials; apart from ART, they did not receive any other treatment. In assessing several proteins associated with inflammation—IL-6, D-dimer and C-reactive protein—a 40% increased risk for cancer was associated with elevated IL-6 levels.

### Study details

Researchers reviewed data from 5,023 HIV-positive people. All participants had been randomly assigned

to the control arms of several clinical trials—Esprit, Silcaat and Smart—and, apart from ART, did not receive additional interventions such as interleukin-2 or structured treatment interruptions.

The average profile of participants when they entered the studies was as follows:

- 80% men, 20% women
- age – 40 years
- CD4+ count – 400 cells
- viral load – undetectable

Participants were monitored for seven years.

### Results

Statistical analysis found that participants with elevated IL-6 levels in their blood had the strongest risk for developing cancer. This link between IL-6 and cancer risk persisted throughout the study and was associated with all cancers studied.

There were a total of 172 cancers that occurred in the IL-6 study, 101 of which were caused by viral infections such as the following:

- EBV – Epstein Barr Virus; linked to the development of lymphoma
- HBV – hepatitis B virus; this can cause liver cancer
- HCV – hepatitis C virus; this can cause liver cancer
- HPV – human papilloma virus; this can cause many cancers such as those of the anus, cervix, mouth, throat, penis, vulva and vagina

The most common cancers were as follows:

- infection-related cancers: anal cancer and lymphoma
- non-infection-related cancers: lung, colon and prostate cancers

The research team suspects that aging is probably driving the increase in IL-6 and cancer risk seen in its study.

Note that the present analysis was based on studies of stored blood samples collected for another purpose. Therefore, its findings are not definitive. However, the relatively large number of participants and the long period of monitoring suggest that its findings are important and intriguing. The next step in uncovering more about the role of IL-6 and cancer risk in HIV infection is to plan and conduct a study of a different design to confirm the findings of the Insight analysis. If the link between IL-6 and increased cancer risk is confirmed, then clinical trials of therapies designed to decrease IL-6 levels could be one possible way to explore reducing the elevated risk of cancer associated with HIV infection.

REFERENCES:

1. Lee JK, Bettencourt R, Brenner D, et al. Association between serum interleukin-6 concentrations and mortality in older adults: the Rancho Bernardo Study. *PLoS One.* 2012; 7(4):e34218.

2. Borges AH, Silverberg MJ, Wentworth D, et al. Predicting risk of cancer during HIV infection: the role of inflammatory and coagulation biomarkers. In: Program and abstracts of the *14th International Workshop on Co-morbidities and Adverse Drug Reactions in HIV*, 19 – 21 July, 2012, Washington DC. Abstract 002.

## B. Muscle weakness

Raltegravir (Isentress) is a highly effective and generally safe part of potent combination therapy for HIV infection. There have been rare reports of cases of raltegravir-associated rhabdomyolysis—the breakdown of muscle tissue leading to muscle weakness.

Muscles are highly active tissues, which require a lot of oxygen. They contain a protein called myoglobin that captures oxygen from the blood and helps to bring this gas to parts of the muscle that burn fuel to release energy. When muscles are damaged they release myoglobin into the blood. This protein and the products into which it is broken down can—in large amounts—cause kidney dysfunction.

Rhabdomyolysis can occur under the following circumstances:

- alcoholism
- serious accidents where tissues are compressed (crush injuries)
- exposure to stimulants such as amphetamine and methamphetamine, cocaine, ecstasy and excessive caffeine
- inherited muscle disorders
- heat stroke
- muscle injury arising from veins being blocked by blood clots
- lower-than-normal levels of phosphorus in the body
- seizures
- very intensive and exhaustive exercise

- chills
- many medicines have been associated with rhabdomyolsis but one class stands out: statins (a group of drugs used to treat high cholesterol levels)

Rhabdomyolysis may not initially cause symptoms but the following signs may appear later:

- dark-coloured urine
- decreased production of urine
- fatigue
- stiff or aching muscles
- tender muscles
- painful joints
- seizures

### Lab tests

Blood tests may reveal abnormal levels of an enzyme called creatine kinase. Levels of the waste product creatinine may also be abnormal.

### Treatment

In some cases, nurses may provide intravenous saline solution to hydrate the body. This solution, in cases of rhabdomyolysis, may also be rich in bicarbonate to help increase the production of urine and accelerate the removal of myoglobin.

In very severe cases of rhabdomyolysis, dialysis (artificial filtration of the blood) may be necessary to remove myoglobin and other proteins temporarily.

Some people quickly regain their energy after being treated for rhabdomyolysis, while others can have fatigue and muscle aches for several months after treatment.

REFERENCE:

Parekh R, Care DA, Tainter CR. Rhabdomyolysis: advances in diagnosis and treatment. *Emergency Medicine Practice*. 2012 Mar;14(3):1-15.

## C. Australia: raltegravir and muscle weakness—a rare complication

Researchers in Sydney, Australia, at St. Vincent's Hospital and the Kirby Institute for Infection and Immunity in Society have been investigating reports of possible muscle weakness (rhabdomyolysis) associated with the use of raltegravir (Isentress). They have found that this complication is rare among raltegravir users. However, they caution that there is the possibility that it could occur among HIV-positive people who use other integrase inhibitors (elvitegravir and dolutegravir), therefore, long-term monitoring of people who use these drugs may be needed.

### Study design

The Sydney researchers compared health-related data from 159 raltegravir users to 159 similar HIV-positive people who did not use raltegravir.

The average profile of raltegravir users in this study was as follows:

- 97% men, 3% women
- age – 50 years
- CD4+ count – 552 cells
- viral load – 92% had a viral load less than 50 copies/ml
- length of raltegravir use – 28 months
- 25% were using lipid-lowering medicines called statins
- 1% had a family history of muscle disease
- 41% had recently engaged in strenuous exercise

### Results

The distribution of muscle-related outcomes was as follows:

Muscle toxicity
- 37% of raltegravir users
- 19% of control participants

Muscle pain
- 19% of raltegravir users
- 3% of control participants

These differences were statistically significant.

### Focus on muscle issues

Six participants who received raltegravir developed muscle weakness in the trunk of their body. The basic features of the six participants were as follows:

- age – 36 years
- most had been using raltegravir for about three years

- two had elevated levels of the enzyme creatine kinase in their blood
- only one of the six participants was using a statin

Doctors performed a number of investigations, including the removal of tiny samples (biopsies) of muscles for analysis. Based on the results of their analyses and other tests, the following changes were made to the regimens of two participants:

- switching from raltegravir to ritonavir-darunavir (Prezista) in one case and to maraviroc (Celsentri) in another

Muscle strength subsequently improved in these two participants.

Taking into account many factors, statistical analysis revealed that exposure to raltegravir was significantly associated with an increased risk for muscle weakness and pain.

However, the length of time that participants used raltegravir or the concentration of raltegravir in the blood was not linked to an increased risk for muscle weakness.

Although elevated levels of creatine kinase are sometimes used to help doctors diagnose cases of rhabdomyolysis, in the present study elevated creatine kinase was significantly linked to "recent strenuous exercise" rather than raltegravir exposure, noted the study team.

The present study is an important first step in beginning to understand the possible association between raltegravir and muscle weakness. However, the study's design and other issues played a role in affecting the robustness of its conclusions:

- There does not appear to be international consensus about a definition of muscle toxicity.
- The study's design was not randomized so it is possible that there were other, unknown factors that could have inadvertently biased the interpretation of the results.
- Another issue related to the study design was that firm conclusions about the possible impact of raltegravir on muscle weakness cannot be drawn.
- The number of participants with muscle weakness was relatively small.

Despite these drawbacks, the researchers have laid the foundation for conducting a bigger, longer study of the possible impact of integrase inhibitors on muscle weakness. This is important because other integrase inhibitors will become available in the future and their potential ability to trigger muscle weakness needs to be investigated. Preliminary results from ongoing trials of two other integrase inhibitors suggest that elevations of creatine kinase (suggestive of muscle breakdown) occur in about 5% of participants.

REFERENCE:

Lee FJ, Amin J, Bloch M, et al. Skeletal muscle toxicity associated with raltegravir-based combination antiretroviral therapy in HIV-infected adults. In: Program and abstracts of the *14th International Workshop on Co-morbidities and Adverse Drug Reactions in HIV*, 19–21 July, 2012, Washington DC. Abstract 015.

## D. The return of Aspirin for HIV infection

Since the early 1990s, researchers have been aware that HIV infection was associated with excessive inflammation. Some researchers suspected that HIV-related inflammation weakened the immune system in particular and the body in general. One drug that can partially reduce inflammation is Aspirin. Laboratory experiments with anti-inflammatory compounds (including Aspirin) and cells and HIV have found that these drugs can partially reduce inflammation and, in some cases, the production of HIV from infected cells.

A pilot study of Aspirin was done in the early 1990s in New York City. However, this study did not uncover any substantial benefit in HIV-positive people. Note that at the time, potent combination therapy for HIV infection (commonly called ART or HAART) was not available.

Since then, Aspirin has been tested and continues to be tested in clinical trials of HIV-negative people. In these studies, daily Aspirin has generally been found to modestly reduce the risk of developing a number of cancers.

Aspirin helps to reduce the formation of blood clots, which can clog blood vessels and lead to a heart attack. However, Aspirin can also lead to an increased risk of bleeding in the stomach, intestines and brain, so Aspirin therapy should always be done under the supervision of a physician.

## HIV and cardiovascular disease

Many studies have found that HIV-positive people have an increased risk for cardiovascular disease. Likely this is brought about by inflammation triggered by chronic HIV infection. In monkeys susceptible to infection with the closely related simian immunodeficiency virus (SIV), researchers have found that these monkeys have an increased risk for cardiovascular disease.

## Platelets

Platelets are small cells found in blood that help to initiate the formation of blood clots. When platelets become activated, they release proteins that quickly cause clots to form. When cuts and injuries occur, such clots help to prevent the loss of blood and death. However, in HIV infection, platelets appear to be prone to activation and excessive incitement of clot formation.

Researchers in New York City recently conducted a relatively short and small study of low-dose Aspirin (81 mg) for one week to assess its impact on several measures of inflammation, clotting and immune activation. They found that after one week Aspirin had beneficial results on laboratory assessments of these issues. A longer and larger study is now needed to confirm and extend these results.

## Study details

Researchers recruited 25 HIV-positive participants on stable ART and 44 healthy controls. The average profile of the HIV-positive participants was as follows:

- 76% men, 24% women
- age – 50 years
- CD4+ count – 630 cells
- current smokers – 56%
- HBV co-infection – 8%
- HCV co-infection – 24%
- family history of heart attack – 16%

Blood samples were collected before and after the study.

## Results

Prior to using Aspirin, lab tests found that HIV-positive participants had platelets that were hyper-reactive. Such a state greatly enhances their ability to initiate the clotting process.

One week's exposure to low-dose Aspirin significantly reduced platelet hyper-reactivity. Moreover, Aspirin appeared to reduce the activation of CD4+ and CD8+ T-cells. Also, in simulated experiments, after one week, white blood cells taken from Aspirin users were more responsive in attacking germs.

There was a general statistical trend for reduced levels of proteins in the blood associated with inflammation such as the following:

- C-reactive protein
- interleukin-6
- D-dimer

No side effects were reported, but then this study used low-dose Aspirin and lasted for only one week. However, the present study provides a needed foundation for a longer and larger study to confirm these results and to assess the impact of this or other doses of Aspirin on the risk for heart attack. Such a study should also recruit more HIV-positive women.

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CATIE, Canada's source for HIV and hepatitis C information, is committed to improving the health and quality of life of all people living with HIV/AIDS in Canada. CATIE serves people living with HIV/AIDS, and the people and organizations that support them, by providing accessible, accurate, unbiased and timely treatment information. CATIE provides such information through a comprehensive Web site, a bilingual toll-free phone service, electronic and print publications, a national reference library and workshops and exhibits at conferences across Canada.

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