Anti-Doping Awareness in Sports

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Lecture -31

Doping Control Way Ahead

Good morning friends, and welcome to today's lecture on Doping Control: The Way Ahead. So this is the start of Week 7, a series of anti-doping lectures brought to you by NPTEL in collaboration with IIT Chennai. I am Professor Dobson Dominic, Head of Sports Medicine and Sports Science at Saveetha Medical College and also the President of the Indian Society of Sports and Exercise Medicine. So in this Week Seven learning, we are broadly going to learn about the Athlete Biological Passport and also the various arbitrations in anti-doping. We are going to have a series of five lectures in Week Seven, starting with an introduction to doping control and the steps ahead.

We will broadly look into the Athlete Biological Passport. We will look into how genetic doping and newer technologies can be controlled. We also will look into the Court of Arbitration in Sports and arbitration in anti-doping. In today's lecture, we are broadly going to look into several regulations and policies in anti-doping, the challenges faced, and several emerging trends in doping such as gene doping, microdosing, and Athlete Biological Passport abuse. We will look into the several methods adopted by WADA and national anti-doping organizations in preventing anti-doping rule violations.

We are looking into prevention strategies in doping control and we will conclude with the future of doping control. Anti-doping regulations and policies. What are the testing procedures? The testing is done both out of competition and in competition. Out of competition, athletes can be tested to prevent doping practice even during the training regimen, not necessarily during competition. In competition, testing occurs during the event to catch any potential violations in real-time.

There are several sanctioning protocols. The WADA court establishes sanctions for doping violations, which can include suspension, disqualification, and stripping of medals won. The length and severity of the sanction depend on the nature of the violation. So, for example, if you are a first-time offender, then the sanction is going to be

less severe, and if you are found to be a repeated offender, then the sanction is going to be much more stringent. What are the types of testing done? Urine testing is the most common method where athletes provide urine samples that are analyzed for prohibited substances. Blood testing is used to detect substances that might be missed in urine testing, such as erythropoietin or blood transfusions.

Biological Passport, a program that monitors all athletes' biological markers over time, allows for the detection of doping practices by identifying abnormal variations. So what are the challenges in anti-doping? Several challenges are resource constraints. Many national anti-doping agencies, including NADA (National Anti-Doping Agency), face funding and personnel shortages. That is, the dope control officer shortages, so there might be a shortage either in funding towards the testing or there might be a shortage in terms of the dope control officers, limiting the scope and frequency of testing. Global disparity: there are inconsistencies in how different countries enforce anti-doping regulations, leading to gaps in the system. What do we mean by that? There is no consistent enforcement of anti-doping regulations.

Evolving doping practices: As detection methods improve, athletes and the support staff like coaches and trainers may develop newer methods to evade testing, such as using designer drugs like synthetic steroids or advanced masking techniques. Some of the common masking techniques include using a diuretic to mask the effect of anabolic steroids. These are all evolving doping practices used by athletes and the support team to avoid detection of banned substances or methods. So, several challenges like resource constraints, global disparity, inconsistencies in different places, and newer evolving doping practices are all challenges to anti-doping. What are the emerging trends in doping? The new trends followed by several athletes are one, gene doping, two, microdosing, and three, Biological Passport abuse.

We will look into this one by one. What is gene doping? Gene doping refers to the use of gene therapy techniques to enhance athletic performance. Gene doping has evolved from gene therapy and this is a newer and latest form of doping practice, and it is very difficult to detect. This involves modification or introduction of genes into an athlete's body to increase the production of specific proteins or hormones that may enhance muscle growth, endurance, or improve the athlete's recovery. All are performance aids which help in the athlete's performance. So what are the benefits and risks of gene doping? The potential benefits are obviously performance enhancement.

The athlete can improve performance. Some athletes think that there are potential benefits with injury prevention, but it is inconclusive. There are ethical concerns like fairness in competition. So one athlete does gene doping and that may create an unfair competition. The access and inequality may result in damage to clean sport.

And what are the health risks for the athlete who might do gene doping? Unintended genetic mutation could lead to serious health complications, which may include even the risk of cancer and severe immune disorders. What are the challenges faced during gene doping? The most important one in anti-doping regarding gene doping is detection. The current limitation is that detection methods for gene doping are still under development, making it difficult to identify athletes who are already using the advanced technique. The second one is Biological Passport monitoring. Although Biological Passports monitor changes in athletes' biological markers like urine and blood over a course of time, identifying specific gene modifications remains complex. Microdosing: what do you mean by microdosing?

Microdosing refers to the practice of taking small subtherapeutic doses of performance-enhancing drugs to improve athletic performance without triggering positive results in drug testing. The doses used are often lower than that which would produce noticeable effects or be detectable in standard testing procedures. The purpose of microdosing is obviously the athlete's performance enhancement and avoidance of detection. So the athletes don't take all the banned substances at a single go. They conceptualize and think that constantly taking the performance-enhancing drugs or substances in small doses, which are less than the therapeutic dose, might be difficult to detect but in the long course might help the athlete in performance enhancement.

This is the concept of this new doping strategy, microdosing. What are the common substances used in microdosing? The main ones are the obvious performance-enhancing substances. The major group is anabolic steroids. Low doses of substances like testosterone or nandrolone can help maintain muscle mass without raising alarm. Stimulants such as amphetamines may be taken in small amounts to enhance focus and energy without the risk of adverse effects. Erythropoietin in small doses can stimulate red blood corpuscle production and enhance endurance without crossing detectable levels.

So these are the common substances used in the microdosing strategy. And what are the detection challenges? The current limitations in traditional drug testing methods are that they are designed to catch large doses of substances. So if the athlete is only taking a small or microdose, it makes it very challenging to detect during drug testing. And what are the advancements in testing? Anti-doping agencies are working to develop more sensitive testing methods and also to employ the Athlete Biological Passport in a much more complex, comprehensive way so as to identify irregular patterns in an athlete's biological markers; that is, the urine and blood sample, thereby helping in detecting microdosing also. Obviously, the Athlete Biological Passport is the major tool for the anti-doping agency to monitor an athlete's biological markers over time. What does it do? It tracks variations in an athlete’s blood and urine samples to detect potential doping. It

establishes a baseline for an athlete's biological parameters and flags significant deviations that may indicate probable doping practices.

So, an Athlete Biological Passport is a very important tool in the hands of the World Anti-Doping Agency and national anti-doping organizations. Athletes are even starting to abuse the Athlete Biological Passport. How do they do that? They manipulate their biological markers to evade detection by using substances or techniques that may temporarily mask the presence of performance-enhancing drugs or substances. This may include either using frequent blood transfusions. Athletes might take advantage of their own stored blood or receive transfusions from others, thereby artificially elevating red blood cell count.

Substance cycling: using performance-enhancing drugs in a strategic cycle helps allow their biological markers to return to normal before testing. So this is also a way of abusing the Athlete Biological Passport. So the two strategies employed by athletes and support staff are either through blood transfusion or through substance cycling. What are the challenges in detection here? Limitation of current monitoring. The effectiveness of the Athlete Biological Passport relies on consistent and accurate monitoring. A change in an athlete's biological parameters can be subtle and may not always indicate doping.

False positives can occur due to legitimate medical conditions, thereby leading to complications in sanctioning athletes. The challenges in doping control are evolving doping techniques, resource constraints in terms of funding and personnel, global disparities in enforcement of stringent regulations, and athlete education and awareness still not being up to the desired level. There are legal and ethical issues in doping control and the doping control process has to be proper and ethical in the eyes of the public. Therefore, public perception is important, and sometimes pressure from media sources can also hamper the doping control process. So the broad prevention strategies adopted in doping control are education and awareness programs, robust testing protocol, collaboration among various testing stakeholders, strict implementation of sanctions and consequences for athletes and athlete personnel, and newer research and development to enable tackling the new doping strategies like gene doping. The future of doping control lies in innovation in detection, like nanotechnology. The development of nanosensors can detect extremely low levels of banned substances in biological samples like urine and blood, thereby providing rapid and highly sensitive testing capabilities.

So even if the biological samples of urine and blood have very small, low levels of the banned substances, nanotechnology will help in detecting that. The second detection technology is synthetic biology. What is synthetic biology? It is a technique that allows for the development of synthetic biomarkers that can be introduced into an athlete's system to enhance the detection of doping practices. Enhanced data analytics and

artificial intelligence, real-time monitoring through AI algorithms can analyze real-time data from wearables to detect unusual physiological patterns that may indicate doping, thereby enabling immediate intervention.

Risk assessment models: the machine learning model can be developed to assess an athlete's risk of doping based on historical data, lifestyle, and training patterns, allowing for targeted testing of susceptible athletes.

To conclude, doping control strategies will also involve personalized anti-doping strategies like customized testing regimens, implementing personalized testing schedules that take into account athlete-specific risk factors and performance data, thereby enabling the optimization of detection efficiency. Also, individualizing the education program, targeted educational resources based on the athlete’s background, the sport, and previous violations, all help in increasing the effectiveness of doping control.

These are the references for today's lecture. Thank you and Jai Hind.