


Practical consequences of blood sampling

by Rune Andersen

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“ *The author draws on his experience of blood sampling, carried out in 1994, during the Winter Olympic Games in Lillehammer, to explain the differences between blood and urine testing. He discusses the possible problems, administrative, physical and ethical, associated with blood testing and suggests ways in which these problems can be solved. He stresses the importance of having experienced, well trained personnel to conduct the blood sampling procedure and favours the use of specially trained bioengineers, rather than doctors, to undertake the actual taking of the samples, since they have much more practical experience of this procedure and, in fact, doctors generally leave this task to them. He concludes by stressing the extreme care needed in compiling the doping control forms and ensuring that they are filled in with complete accuracy.* ”

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During the 1994 Winter Olympic Games in Lillehammer, blood samples were taken as part of the doping control procedure in selected sports for the first time in Olympic history. Blood testing was introduced by the International Skiing Federation (FIS) in the World Championships in Lahti in 1989. Since then, blood tests have been used routinely by FIS as a supplement to urine tests in championships and major World Cup events.

In 1993, the IOC Medical Commission decided to recommend that, in the 1994 Winter Olympics, blood tests as prescribed by FIS should be carried out in competitions run under the auspices of the FIS. The FIS has decided that blood tests are to be taken in all ‘their’ events – i.e. cross-country skiing, ski jumping, Nordic combined, alpine skiing and freestyle events. In fact, only cross-country skiing utilised blood testing during the Games.

The IOC Medical Commission also decided to support any similar initiatives taken by other international federations but none other decided to take blood samples during the 1994 Olympic Games.

Our prime objective for the Lillehammer Games was to develop a secure, simple and efficient procedure for blood sampling and transportation. The procedure also had to be legally beyond reproach and acceptable to the athletes.

Some of the differences between urine and blood testing which may have practical consequences will now be considered:

- Blood sampling procedure is new to athletes;
- The blood sampling procedure requires invasive techniques which may be associated with pain and anxiety;
- Blood is not a waste product;
- On-site preparation of blood samples may be required;

- Blood sampling carries a risk of disease transmission unless proper procedures are employed;
- Medical personnel are required to perform the blood sampling procedure;
- There is an increased probability that disease will be detected.

The procedure is new to athletes

The introduction of new procedures requires that athletes and coaches need information. This is particularly important in a matter as sensitive as doping control, if the procedures are to be well received. For international athletes it is a problem that procedures for doping control can differ from one country or championship to another. Unfamiliar equipment, forms and slight procedural differences may encourage a sense of insecurity during the control procedures. Before a new procedure is introduced, athletes and their support teams must be given an opportunity to study it.

Furthermore, athletes must be given an opportunity to have the procedure explained to them before it gets underway. This will increase the time needed for the doping control procedure in the beginning, as a thorough explanation may take up to 30 minutes. Therefore, provisions for information must be considered in the regulations and in the logistical planning of each nation's doping control system.

Invasive techniques are required

While urine testing is merely intrusive, blood testing is an invasive procedure. Most athletes are used to having blood samples taken as part of their regular health and training controls, but for some the procedure may be associated with anxiety. There is also an element of pain associated with venepuncture.

Some ways of minimising athletes' anxiety have been suggested. Again, it is very important that the athlete is well informed about the procedure. It has also been suggested that team physicians may take the samples, that lidocaine (lignocaine) gel should be used as a local anaesthetic prior to sampling, and that the number of sampling attempts be limited – e.g. to three or five.

Since some athletes have a close relationship with their team physicians, it may seem attractive to have the samples taken by someone they know and trust. However, the equipment used may be unfamiliar and not

all team physicians have blood sampling as part of their daily work routine. We suggest, therefore, that blood samples should be taken by a trained bioengineer who is familiar with the sampling equipment.

We do not advocate the use of a local anaesthetic gel. This carries the slight risk of sample contamination with lidocaine. Also, venepuncture with modern equipment and trained personnel is merely uncomfortable rather than very painful.

Finally, the suggestion that the number of sampling attempts should be limited is not recommended since, with trained personnel and athletes who are presumably young, healthy and co-operative, more than one attempt will very rarely be necessary. Problems could arise with an athlete who, for some reason, e.g. fear of doping detection, does not co-operate during the venepuncture procedure. Such a situation must be handled properly and carefully but there must be no possibility of an athlete evading doping control by exploiting a provision in the regulations.

Blood is not a waste product

Urine is a waste product and may be collected without ill-effects to the athlete but blood is not. The haemoglobin content in the body is crucial to the athlete's oxygen-carrying capacity and, therefore, to performance capacity in endurance sports. Thus, the amount of blood drawn in doping control should be as small as possible.

The normal daily loss and production of red blood cells amounts to 15-20ml. Since blood consists of plasma as well as red blood cells, this is equivalent to 40-50ml of blood. The amount of blood drawn in previous doping controls done by FIS and IAAF has been 20ml, usually expressed in the regulations as "less than 25ml." This volume of blood is considered to be insignificant for performance, since it amounts to less than 0.4% of the total blood volume and will be replaced in less than twelve hours.

Some events may involve repeated testing of the same competitor. In these cases, we propose to introduce a random selection procedure. This may take the form of drawing lots, where the athlete has one chance in three or four of a repeated blood sampling procedure, if a blood sample has been taken within the last 48-72 hours.

In conclusion, the blood taken should be limited to the amount needed for the analyses planned. This should not pose any prob-

lems for performance, as long as the volume is kept to less than 25ml. A random selection procedure is recommended in a repeat test situation.

On-site Sample Preparation

Depending on the analyses planned in the laboratory, blood must be separated into different components before analysis – e.g. red blood cells, plasma or serum. This separation may require clotting, sedimentation and/or centrifugation. Depending on the kind of analysis planned and on the duration or mode of transport, some form of separation procedure may be required on-site at the doping control station before the transportation of the samples. Different kinds of prepared blood tubes may be needed for the same reasons.

The main planning concerns are security, simplicity and efficiency. Thus, the blood sampling procedure should be conducted in a different room from urine testing. For security reasons, unsealed samples from more than one athlete must never be allowed to be present in the room, (e.g. in a centrifuge). If on-site sedimentation and centrifugation of the samples are required, this could mean that an additional time of 40-50 minutes is needed for each athlete, unless samples are adequately sealed prior to the separation procedure.

Although on-site preparation was not necessary for the controls at Lillehammer, we had worked very closely with Versapak, developing a sealed transport container, which can be fitted into a standard table centrifuge. In this way, separating procedures can be carried out after the sample has been securely sealed and after the athlete has left the control room and the procedure can be performed efficiently as well as securely.

Risk of disease transmission

It has been argued that blood testing should not be done because of the risk of disease transmission. However, this risk can be eliminated by using sterile procedures, sterile non-reusable equipment and trained medical personnel.

Increased probability of disease detection

Any doping control analysis, whether of urine or blood, can lead to abnormal laboratory findings caused by disease. Analysis of

blood samples increases the total number of analyses, and thus increases the chance of abnormal findings unrelated to the use of performance-enhancing substances or methods. This is particularly true of blood analysis, since common haematological parameters like haemoglobin concentration can indicate common diseases, e.g. anaemia.

An important issue brought out strongly by the introduction of blood tests is, therefore, what to do with abnormal laboratory findings. Should the athlete be informed? And if so, should he be informed directly, through his team doctor or through his federation?

The pros and cons of this issue have been argued thoroughly in the case of HIV population prevalence studies but such studies differ from doping control in that participation is voluntary. Participation in sports is voluntary but, once you participate, doping control is not. Thus we would argue that athletes have a right to decide whether they want to be informed of pathological findings. Moreover, it should be their own choice whether they want to be informed directly, through their doctor or through their federation.

Consent forms

In 1993 the IAAF introduced blood testing for the first time in a summer sport. In its procedure the IAAF has introduced the signing of forms prior to sampling. It can be argued that, since blood sampling is an invasive procedure, prior consent is necessary.

However, in doping control the issue of informed consent is more complex than in medical research. It could be argued that an athlete who has participated in a competition or entered into an advanced training programme is usually obliged to submit to doping control on request. Failure to submit a sample will usually be prosecuted as if the athlete had tested positive. If used, therefore, consent forms should be signed before the athlete enters competition or an organised training programme, or joins a sports organisation. The use of consent forms after competition, but prior to sampling, is of limited value, since this is no longer a voluntary situation in terms of possible sanctions against the athlete.

Conclusion

Blood tests can be carried out in a secure, simple and efficient way. However, the use of blood testing raises a number of practical and ethical issues, which should be considered by

the various sporting bodies responsible and the results incorporated into the control procedure.

Certain aspects of doping control procedure at the Winter Olympics in Lillehammer are worthy of comment:

- 1 Doctors who took blood samples wore badges stating they were medically qualified and able to take the blood tests required by the IAAF and the FIS.
- 2 Consent forms were signed and the control procedure explained to athletes. As I have said, this can take quite some time.
- 3 Blood sampling equipment is the same as the urine sampling equipment. It includes vials which may be of different sizes and with different vacuum levels in the vials. In the IAAF a maximum of 25ml can be collected. During the Olympics the maximum was 4ml, since the IOC only wanted to test for foreign blood – not for other things.
- 4 In the Olympics, there was only one vial for each sample (A and B) of 2-4ml each.

Athletes should have a choice of different packages for blood samples. There are different ways of putting these four vials into these boxes and the box can be put in a table centrifuge.

The right equipment is, of course, necessary. I will not go into detail about the equipment you need for blood sampling – I am not a medical expert and this has to be dealt with by the professionals. In Norway we have chosen to train ten bioengineers to do this. We

actually believe bioengineers are more suitable for blood sampling than doctors. They carry out this procedure sometimes hundreds of times a day in laboratories and they know exactly what to do. Doctors usually leave this work to the bioengineers.

You have to plan this. You need the equipment for placing the vials and you have to think the whole procedure through beforehand. At the IAAF meeting for the Golden 4 last year we thought we had anticipated everything but we had not. It is important to carry out the actual venepuncture in a systematic way, so that you know what you have and what you still need.

This is a metal casing that is impenetrable to microwaves or needles. It is locked in the same way as the urine sample case.

In the Olympics we had one form for blood sampling and one for urine sampling and the notification is given on the same form. We also designed the forms so that it would be impossible to miss anything out. There are white areas and all the white areas have to be filled in.

If for any reason you do not fill any of them, they should be crossed out. This is one of the points we are trying to stress. Be sure not to make any mistakes. This is very important.

