Project Review

"Storage contamination as a potential diagnostic test for autologous blood transfusion"

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Autologous blood transfusion is banned; however currently no test exists to detect this form of blood doping. Anecdotal reports suggest that elite athletes have been using autologous transfusions since at least the 1980s, and the Operacion Puerto scandal in Spain has revealed that some athletes continue to utilise transfusions. Blood must be withdrawn, then stored for several weeks prior to reinfusion (in the meantime the body replenishes the depleted blood so that there will be a corresponding boost in the total quantity of blood cells in circulation when the blood is finally reinfused). Blood is either refrigerated or frozen in specially designed blood storage bags.

Whilst the blood is in contact with the storage bag, it is known that there is an exchange of material between the plastic storage bag and the blood. Since the storage bags are man-made, the synthetic compounds that find their way into the blood are not normally found in the body.

Their presence in a doping control sample may therefore be used as a diagnostic test for the prior use of autologous transfusion. This project will investigate whether the presence of plastic compounds in blood samples are sufficiently distinct to enable their use as a diagnostic. Pending the successful outcome from this first stage, we will extend our studies to document the persistence of these markers in volunteers after they have received blood transfusion to establish the likely window of detection associated with this type of testing.

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Results and Conclusions

Two approaches were investigated to detect the presence of DEHP in reinfused red blood cells (RBC). The first approach was indirect and based on the hypothesis that DEHP was antigenic and that development of a suitable antibody could allow the flow cytometric detection of DEHP-contaminated cells. Substantial efforts were made to develop a monoclonal antibody against DEHP, however these attempts were unsuccessful. Because of the lack of these antibodies, this component of the research had to be abandoned.

The second approach was direct and turned on the ability of GC-MS to detect trace amounts of DEHP in lysed RBC membranes. Provided that rigorous measures were taken to avoid contamination during sample preparation and analysis, we demonstrated that the DEHP levels found in the membranes of stored RBC could be easily distinguished from background levels. However DEHP levels in RBC fell rapidly once the cells had been reinfused into circulation.