

★ Deep vein thrombosis is a medical problem attracting increasing public attention. With pressure intensifying to improve the speed and accuracy of diagnosis, Professor **Zulfiqur Ali**, a key member of the DVT-IMP project, tells us of their work to develop a mobile, accurate testing procedure

DVT: waking up to the reality of the threat

DVT are three letters that have acquired ever-greater significance in recent years as the public has become increasingly aware of the risks associated with deep vein thrombosis, a severe condition where blood clots form in one of the body's deep veins (usually in the leg). DVT and pulmonary embolism (when a clot lodges in the lung), are causing increasing concern amongst society at large. Key factors that can make an individual susceptible to DVT include underlying genetic disorders and other diseases., age, immobility - particularly in cramped conditions, and obesity. The DVT-IMP project, an FP6 STREP project, are

between them, the scale of the opportunity, not to mention the strength of will to alleviate the problem, becomes clear.

Confronting the problem

Professor Zulfiqur Ali of Teesside University, one of the prime movers behind the project, is in no doubt as to the scale of the problem. "DVT and associated conditions are actually the most common cause of unexpected death in developed nations, so clearly it's a very significant problem," he explains. "Although many people associate DVT with air travel the idea that it is a 'disease of affluence' has been overstated." The reason

The consortium, whose expertise crosses a wide range of disciplines, including development of the immunoassay system, design of a novel microfluidic cartridge system with a reader device and development of novel eHealth software, is developing a portable test and device to measure concentration of d-dimer - a marker of recent blood-clotting - in whole blood. "The test will measure concentration of d-dimer in a blood sample, this will indicate whether the patient is suffering unusually high blood-clotting activity and so predict whether they may be suffering from DVT," says Ali. "On the other hand you might have somebody who's been diagnosed as having DVT and is receiving treatment. There is always going to be a certain amount of concern in their blood d-dimer concentration, again because it's a marker of increased blood clotting. It may be useful to monitor it during treatment" Another issue, longer term, is that living with an illness can prove highly detrimental to an individuals quality of life, something that concerns Ali. "If you can enable a long-term sufferer to measure his or her own blood d-dimer concentration using an easy home-test, sending results electronically to his Doctor or Clinic, then that's going to give them control of their life, and a certain peace of mind. It has the potential to provide reassurance for sufferers."

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working to develop a handheld, fully portable device that will improve the speed, reliability and accuracy of diagnosis.

The project team is drawn from the University of Teesside, Claude-Bernard University in Lyon, Comenius University in Bratislava, Parc Cientific de Barcelona, Fraunhofer Gesellschaft, Budapest University of Technology & Economics, Universite Paris-Sud and the UK-based companies Helena Biosciences, Haptogen Ltd and Cenamps. Reflecting the widely-acknowledged urgency of the issue, this Consortium of leading universities and prestigious companies attracted funding of €3.3 mn from the European Commission Information Society and Media Directorate Generale. With the consortium members having committed a further €2.2 mn

that DVT can be difficult to diagnose early is that symptoms are not always obvious in sufferers. This is an issue that Ali is keen to address: "Currently diagnosis of DVT can only be confirmed by specialist tests performed in hospital, this is something that we are trying to change, by giving practitioners and patients a test that is just as reliable as a diagnosis but is handheld and portable so it can be used in a range of locations by non-specialists" he explains. "Currently diagnosis is usually confirmed by an ultrasound test, which is expensive and requires specialist equipment and interpretation. Blood tests are already used as part of a diagnosis, and these are highly accurate, however they must be performed in a laboratory. There's a real need for a simple, portable test."

Empowering the patient

The aim of the Consortium is to develop a handheld, portable test that is quantitative, sensitive and specific, a theme developed by Professor Ali. "Current handheld tests are qualitative, they give a good indication of d-dimer concentration in a sample, but don't give a numerical readout. We are developing a new quantitative test in a hand-held,

portable device.” At the moment DVT diagnosis is relatively restricted in terms of where it can be undertaken, something which clearly limits the conditions treatment given that it can strike almost anywhere. This is something the consortium are keen to address, reflecting a general trend in healthcare towards giving patients greater knowledge and understanding of their condition. This fits in with the growing belief that continual management and monitoring of the condition is the best route to long-term health.

Many observers have suggested that modern healthcare will be increasingly ‘consumerised’, with patients taking a more active role, and indeed the Consortium as a whole are keen to make their device as accessible as possible. “The device will be reliable, but also portable and user-friendly, with output that is easy for users to interpret” says Ali. “The device may be used in a GP surgery, in an accident and emergency department or by a paramedic on call. However, it may be that the patient will run the test and interpret the results.” It is clear that the portability of the device is an aspect that sets it apart and thus particularly excites Ali: “One of our goals is to enable patients to self-test. Early

indications are that patients are interested in this, however we will take the lead from clinical practice in deciding whether this is appropriate”

Looking to the future

The Consortium plans to attract further investment from the private sector for the next stages of development, but as yet no decision has been made as to how and where the device will be marketed. “We’ve got partners across a number of countries,” points out Ali. “All of the partners will link in with their own countries’ health systems, and we hope we will get plenty of feedback from all of them.” This kind of international project provides the ideal environment for the development and testing of the device, something which is clearly of great importance to its long-term prospects. It is hoped that an initial, small-scale trial will be undertaken by 2009.

In the fight to improve DVT diagnosis the DVT-IMP project Consortium is in the front line of development. With its emphasis on accuracy, portability and mobility the consortium will provide an innovative solution to the problem and give patients both more control and responsibility for their own healthcare. ★

At a glance

About the DVT-IMP Consortium

The DVT-IMP Consortium is developing a novel, highly accurate assay in a portable device to measure d-dimer concentration in whole blood at point of care. The project uses the latest advances in impedimetric measurement, bio-molecular engineering, lab-on-a-chip, wireless ICT and nano-technologies. The scientific aim of the Consortium is the advancement and integration of four key key bio-nano-informatics fields. These are:

- bio-engineered D-dimer antibodies for development of high specificity diagnostic immunoassays
- Nano/micro engineered impedimetric analysis electrodes incorporating a biocompatible conducting polymer substrate
- Development of an advanced eHealth medical diagnostic software system
- Development of a disposable microfluidic manifold specifically enabling a diagnostic assay at the point of first contact

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Professor Ali has particular research interests in diagnostics and nano-microfabricated systems. He works at the University of Teesside in the IDEAS Institute.



Air travel is commonly associated with DVT