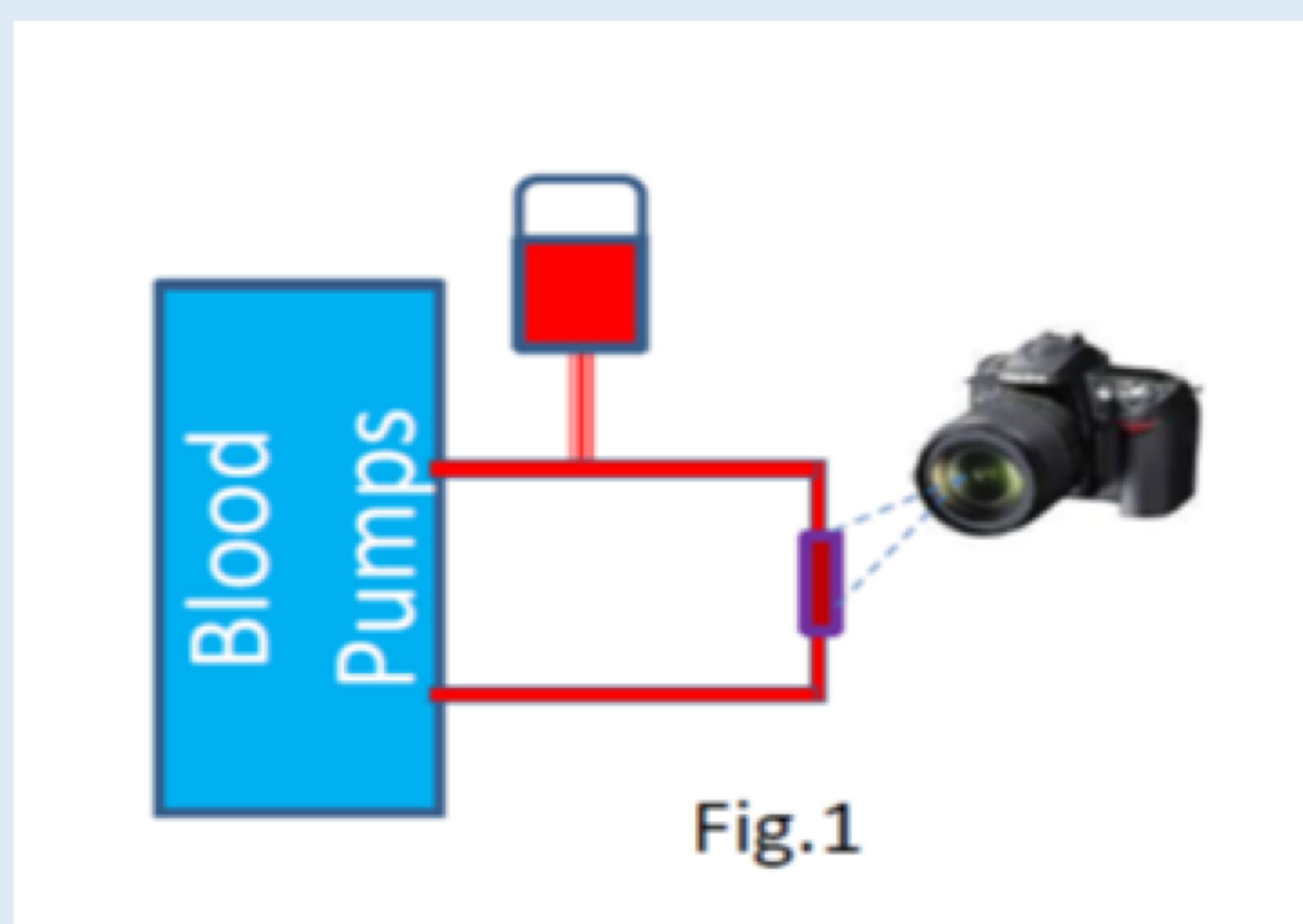


## Background and Aims

Determination of vascular access flow (Qa) in arteriovenous fistulas in hemodialysis (HD) patients is an important component of patient care. Currently, no methods are used to measure access flow are on a routine basis; for example, ultrasound techniques require specialized training. To determine Qa in HD patients, we explored the video image process (VIP) technique (Williams, et al., ASN abstract, page 525A, 2015). This method is a contact-free technique based on the principle of optic flow to measure the number of pixels that change between two consecutive video frames. The aims of this in vitro study were to 1) evaluate whether the change in Qa in a blood line can be measured by VIP technique; 2) determine the relationship of by VIP measurements to actual Qa.

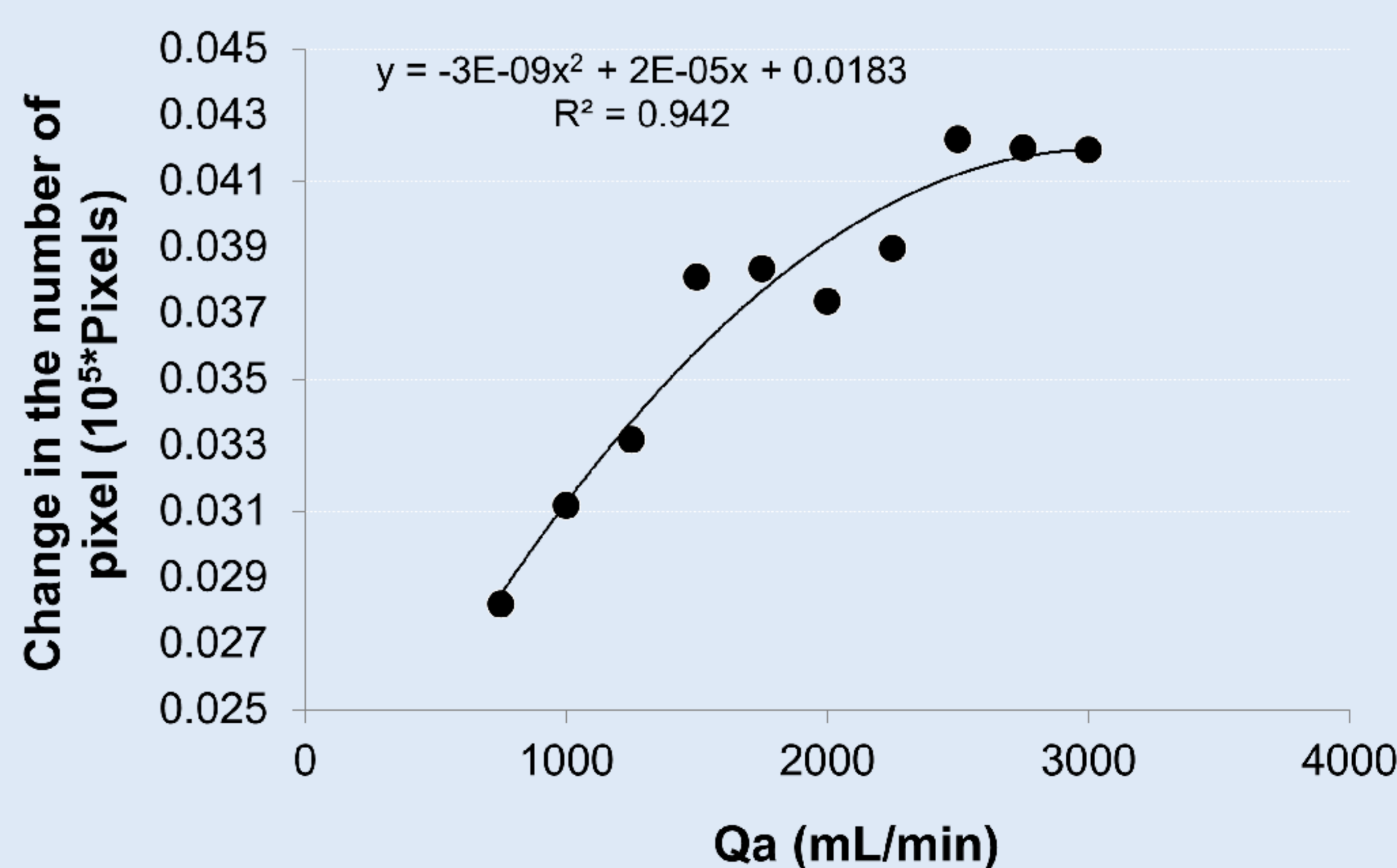
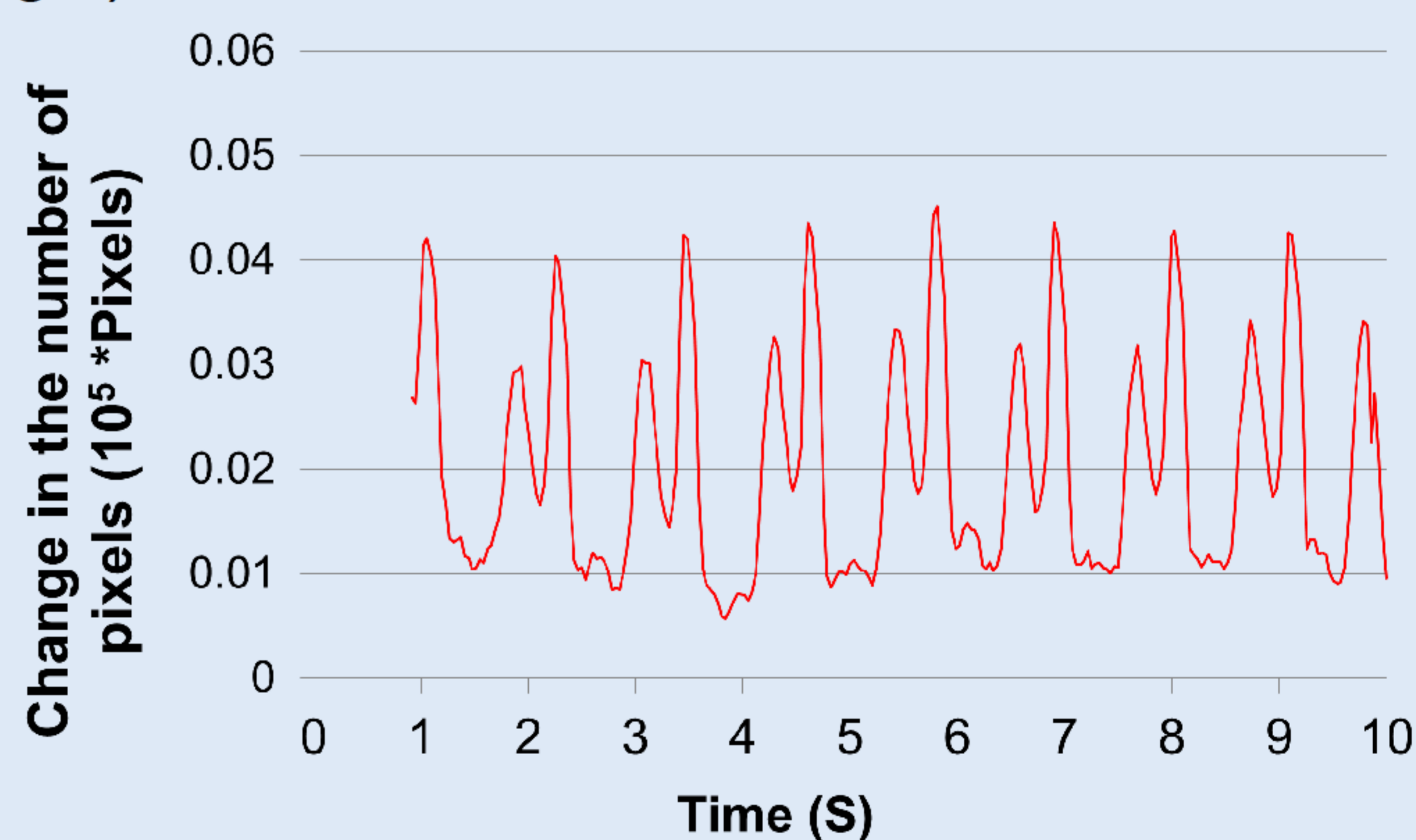
## Methods

Qa was obtained by using a commercially available pump which delivers flow patterns comparable to arterial flow (Model 1423, Harvard Apparatus, Holliston, MA, USA) (Fig.1). We set Qa by changing the stroke volume of the pump in 10 equal increments between 15 mL to 60 mL; the pump stroke rate was kept constant at 50/min, resulting in a Qa between 750 and 3000 mL/min. Video was recorded with commercial camera (Nikon D90). At each level of Qa 10 sec duration of video was recorded using at a 30 frames/s rate. The Matlab image processing tool box was used to convert the change in a number of pixels between two frames in the video image to a time-variable waveform which indicates change in diameter when Qa change. Average peak points of the waveform represents maximal change in the number of pixel. Relationship between change number of pixels and a known Qa was evaluated using non-linear regression analysis.



## Results

The average peak pixel changes was expressed as number of pixel\*10<sup>5</sup> between two consecutive frames. A sample of results with a Qa of 2500 mL/min is shown in Fig. 2. The average value of maximal change in pixels was highly correlated with change in Qa across all 10 flows (R<sup>2</sup>=0.94, p<0.001; Fig.3).



## Conclusion

The results of this in vitro study demonstrate the principle ability of VIP to measure Qa. It's low cost and the contact free nature of the procedure, makes VIP particularly attractive. These in vitro data need clinical validation.