Introduction: Surgeon assessment of visual ‘quality of perfusion’ (QOP) influences kidney discard and predicts transplant outcome. However, this assessment is subjective and bias-prone.

We aimed to design an application utilising a smartphone camera to make this assessment objective and enhance decision making.

Methods: The QOP in photographs of backbench kidneys was graded from 1 (ideal) to 5 (very poor) by three independent surgeons. A training cohort was used to develop an image-analysis algorithm, which was validated in a separate cohort.

Results: Analysing surgeon scores of 174 kidney images revealed that inter-rater agreement was good for kidneys displaying the best (rated 1) and worst (rated 4 or 5) QOP. However, for intermediate scores inter-rater agreement was poor. Inter-rater agreement between surgeons decreased as they graded more images; as surgeons fatigued, their ability to classify images worsened. A training cohort (n=174 kidneys) was used for algorithm development. First, small regions within each image were mapped within the CEILAB colour-space, where well-perfused and poorly perfused areas show clear separation. To generate a score for each kidney these regions are compared with ideally flushed kidney tissue. Testing our algorithm (validation cohort - n=29 kidneys) revealed strong correlation between image-analysis QOP score and surgeon assessment, r = 0.789 (0.587–0.899), P < 0.001.

Conclusion: Surgeon inter-rater agreement on kidney QOP is low for kidneys with borderline QOP and worsens with fatigue. We provide a QOP score utilising an image-analysis algorithm, which correlates with surgeon scoring. With additional images and training this could provide an objective, numerical, point-of-care assessment of organ quality.

Take-home message: Current visual assessment of transplant organ quality is subjective and bias-prone. This body of work attempts to create a point-of-care image-analysis application to provide an objective numeric organ quality score.