None of these variants corresponds to those found in the family that we are reporting.

Explaining the phenotypic variability in both siblings is complex. The proband did not present his first symptoms in the immediate prenatal or postnatal period, as described in the majority of ARPKD cases. Presently the patient is at stage 3 of KDIGO classification, at an age that most patients who have survived would require renal replacement therapy.[7] Obviously, in her sister the signs of the disease could appear late, a reason to maintain her under surveillance. It is possible that in this family there is an active DNA methylation process as has been described in the autosomal dominant variant.[8]

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## Letter to the Editor

# Assessment of tunnelled haemodialysis catheter insertion site using a thermal camera attached to a smartphone: a pilot study☆

## Valoración del orificio de inserción del catéter tunelizado para hemodiálisis mediante el uso de cámara térmica acoplada a *smartphone*: estudio piloto

*Dear Editor,*

Infection of tunnelled haemodialysis catheters is one of the most common causes of morbidity and mortality in this population; catheter-related bacteraemia being the most serious event involving infection. This is caused by microorganisms which colonise the insertion site, the connectors and, less frequently, the infusion fluid.[1] We therefore believe it is important to find methods that may help to prevent this type of complication.

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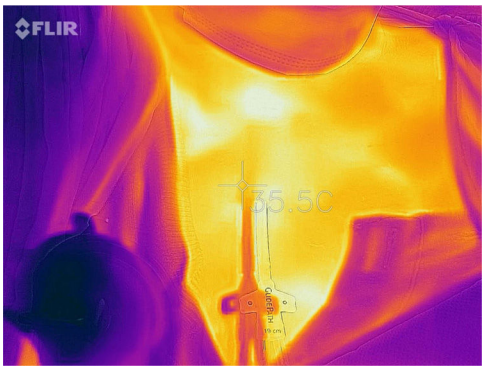


**Fig. 1 – Example of a thermal photograph of the catheter insertion area belonging to one of the patients.**

Thermal imaging has been used in various fields to indirectly measure body temperature. In medicine, it has been used to measure the effectiveness of anti-inflammatory therapy in rheumatic diseases and in the management of chronic wounds, burns and fractures, under the premise that inflammation causes vasodilation and an increase in tissue metabolism, conditions which may promote a local temperature change.[2,3] Initially, however, its main disadvantage was the difficulty of using it in a real clinical setting due to size and cost.

To combat this, infrared cameras have recently emerged which are adaptable to *smartphones*, allowing real-time thermal measurement, in two dimensions, and at the patient's bedside. It is an objective, non-invasive and safe technique for the patient.

Our aim was to assess differences in temperature between the catheter insertion site and the skin on the contralateral side. We used the third generation Flir-One® Pro camera (FLIR Systems, Inc., Wilsonville, OR) with a dynamic range from -20 to 400°C and a resolution of 0.1°C. We designed a descriptive observational study with 33 chronic haemodialysis patients with tunnelled jugular CVC. Three thermal photographs were taken of both the CVC insertion site and the contralateral side of the same patient at the beginning of the dialysis session, without having performed any action on the site, and the presence of classic signs of infection such as redness or exudate was taken into account.

A 15 cm tripod was used for a standardised measurement, and we considered the average of the 3 temperatures obtained in the thermal images. With these values, the ratio between the contralateral temperature and that of the CVC site was calculated for each patient.

Our results were as follows: the mean temperature at the insertion site was 35.19 °C (±3.19 °C) and that of the contralateral side 36.21 °C (± 2.34 °C) ($p = 0.008$) (Fig. 1).

The mean of the ratios between the contralateral temperature and that of the insertion site was classified taking into account the presence (N = 5) or absence (N = 28) of signs of infection and the results were: $0.97 \pm 0.026$ vs $1.05 \pm 0.104$ ($p = 0.035$), respectively. These data imply that a potentially infected insertion site has a higher temperature than the skin on the contralateral side.

There have been no previous studies using thermal imaging to assess catheter insertion sites. However, various studies have shown the value of thermal imaging in the detection of local swelling, especially in diabetic patients[3–6] and, more recently, in the detection of suitable small perforating vessels for pre-surgical mapping in reconstructive surgery, with a diagnostic potential similar to that obtained by tomography.[7] This gives us an idea of the scope of an instrument that can detect minimal temperature changes on the body surface.

In conclusion, the Flir-One® thermal camera detects local temperature changes at skin level in patients with tunnelled catheters for haemodialysis and, in the absence of further studies, it may become a helpful tool in the early detection of this type of infection.

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