THERMOGRAPHY: AN ALTERNATIVE TO ANGIOGRAPHY FOR VASCULAR ACCESS SURVEY IN HAEMODIALYSIS

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Summary

Results obtained by thermography and angiography in surveying vascular access have been compared in 33 haemodialysis patients, including 23 with Cimino arteriovenous fistulae and 10 with homografts and heterografts. In 23 of 30 patients, blood flow stealing through collateral veins, or venous stenosis was detected by thermography and confirmed by angiography. Thermography seems a quick and simple method in routine conditions, restricting angiography to selected patients for whom a surgical revision of the fistula or of the graft is needed.

Introduction

Vascular access is a continuous problem in haemodialysis patients. In our experience, functional survival at 12 months is 85% for Cimino arteriovenous fistulae and 60% for saphenous homografts; surgical repair is required in 7% and 16% of patients, respectively [1]. The survival rate of bovine heterografts is higher in some series, reaching 85% [2] and 87% of patients [3] at 18 months, but revision of the graft is required in 19% [2] and 41% of patients [3].

Angiography is until now the only available survey of arteriovenous fistulae, but it may be a painful and feared method in some patients, and cannot be easily repeated. Angiography may also be undesirable in patients with histories of intolerance to contrast media. Thermography seems a useful alternative in such cases [4].

Patients and Methods

During the past year, we used thermography routinely in surveying our haemodialysis patients, by means of flexible tapes of encapsulated liquid crystals*. Tapes with temperature (T°) range of 34° – 36°C were commonly used, except in a few patients with low flow fistulae in whom tapes with a T° range of 32° – 34°C were used.

* Bayer Pharma, Leverkusen, FRG
Figure 1a. Patient RA ...... Radial arteriovenous fistula

Figure 1b. Patient RA ...... Thermography disclosed a blood flow stealing through collateral veins

Figure 1c. Patient RA ...... Angiography confirmed thermography findings
Figure 2a. Patient BA ...... Radio-cephalic saphenous homograft

Figure 2b. Patient BA ...... Thermography. Stenosis of the venous anastomosis

Figure 2c. Patient BA ...... Angiographic aspect of the stenosis (arrow)
The tapes were applied upon the arteriovenous fistula of the patient after cooling the arm by ventilation. A flashlight photograph was then taken perpendicularly to the arm. The vessels appeared in blue on a black background (Figure 1b). Results were systematically compared with those obtained by angiography.

Thirty-three patients were studied, including 23 with Cimino fistulae (20 radial, three humeral), eight with saphenous homografts (seven straight and one loop graft) and two with bovine heterografts (one straight and one loop graft).

Results

In patients with Cimino fistulae, thermography showed, in 13 cases, a blood flow stealing through collateral veins, leading to surgical ligature in five (Figures 1a, 1b and 1c); used just preoperatively, thermography was particularly useful to the surgeon to localise with accuracy the stealing veins. In four other cases, a stenosis of the main vein was seen.

In six grafted patients, a narrowing of the venous anastomosis was detected (five straight and one loop graft; Figures 2a, 2b and 2c), requiring a surgical repair in five.

In all, angiography confirmed thermographic findings. In each patient with vascular stenosis, a ratio was calculated comparing the narrowest portion of the vessel and the greatest calibre of the same vessel, as appeared by thermography and by angiography. There was no statistical difference between the ‘narrowing ratio’ observed by either method (paired Student’s t test, n = 10).

Thermography failed in two cases with stenosis of the radial artery, and in one case with humero-axillary homograft whose venous anastomosis could not be evidenced by thermography because of its proximal location.

Conclusion

Thermography seems a quick, simple and safe method for vascular access survey in haemodialysis patients. It can be repeated and should restrict angiography to patients for whom a surgical revision of the arteriovenous fistula is mandatory.

References

3 Vanderwerf, BA, Rattazzi, LC, Katzman, HA and Schild, AF (1977) Dial. Transpl., 6, 27
4 Sachs, RN and Tricoire, J (1977) Nouv. Presse méd., 6, 465

Open Discussion

BERGSTROM (Chairman) May I ask you one simple question, how long does it take to make a complete investigation of a fistula or a graft, is it very time consuming?
MASSELOT  The examination by thermography takes about five minutes, so it can be performed during the consultation and it was an advantage for our home dialysis patients that we see regularly, but not thrice a week.

HAWKINS (Birmingham) How much do the thermography tapes cost, and can you use them for more than one patient?

MASSELOT  The thermography tapes you have seen here cost about 70 dollars. The thermography screens, I am sorry to say I do not know the price, but I think it is about the same. I can tell you that during the past year we used two or three tapes for the whole year, and 70 to 100 patients were investigated.

Note: We regret any loss of clarity in these figures which for reasons of economy we could not reproduce in the original colour