

## Why do Italian stroke patients receive CT scans earlier than UK patients?

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### Summary

**Computed tomography (CT) scanning is important prior to acute stroke treatment. We wished to identify factors associated with being able to obtain a CT scan quickly, from a recent large stroke treatment trial. A questionnaire survey on the organisation of CT scanning services for stroke was sent to 179 UK and Italian hospitals who had randomised patients into the International Stroke Trial and performed at least one pre-randomisation CT scan. Data from the questionnaire were analysed in conjunction with other patient data. Italian doctors expected the CT scans to be done more quickly than UK doctors, their hospitals were more likely to have a CT scanner operating all the time, and a porter was used less frequently to take the patient to the CT scanner. A few simple changes in the way CT scanning is organised for stroke patients in the UK could speed access to CT considerably.**

**Keywords:** stroke; cerebrovascular disease; computed tomography

It is not possible to differentiate ischaemic stroke from haemorrhagic stroke reliably by clinical means alone, so rational antithrombotic treatment can only begin after computed tomography (CT) or magnetic resonance imaging (MRI). 'Time is brain', particularly if thrombolytic therapy is being considered,<sup>1</sup> so rapid CT scanning is essential.

The International Stroke Trial (IST) was a large, multicentre randomised controlled trial of aspirin, low- or medium-dose subcutaneous heparin, aspirin and heparin, or neither, started within 48 hours of stroke. CT scanning was not essential, but pre-randomisation CT was encouraged. Thus, although hospitals were encouraged to randomise patients quickly, the 48-hour time window reflected the clinical reality that many stroke patients do not reach hospital quickly and some hospitals in some countries may have only limited access to CT for stroke patients.

Of the 19 435 patients in the trial, 3165 patients (16.3%) were randomised into the IST within 6 hours and 7279 (37%) within 12 hours of their stroke. There was considerable variation in the times to randomisation, with or without CT, both between the 34 participating countries, and between each of the hospitals

within each country. Thus we thought that a study of the organisation of CT services in a large sample of the hospitals might provide insight into the characteristics of hospitals that are able to obtain a CT scan quickly. We therefore collected data from hospitals in the two countries (the UK and Italy) that entered the most patients into the IST.<sup>2</sup> Restricting the sampling to the UK (5789 patients entered from 110 hospitals) and Italy (3113 patients entered from 77 hospitals) was the most practical way of capturing the largest proportion of hospitals and patients in the smallest number of countries.

### Materials and methods

The design and results of the IST have previously been published.<sup>2</sup> In the last year of recruitment into the trial (1995/6), a questionnaire was distributed at meetings of participating UK and Italian hospitals, and was posted to all UK hospitals who had not attended the meeting. In this way we contacted 179 hospitals (40% of all IST hospitals who had randomised at least one patient with a CT scan) which had randomised a total of 5031 patients into the IST with a CT scan (39% of all patients randomised into the IST with a CT scan). We did not seek replies from non-responders as it was more important for them to concentrate on complete data collection in the IST.

The hospital doctors were asked if they had a different CT request policy for IST and non-IST patients and if they did were asked to complete two questionnaires clearly marked 'IST' and 'non-IST'. The questionnaire asked whether the doctors routinely asked for a CT scan on stroke patients regardless of trial eligibility. If they did, they were asked to specify the number of hours they requested that the scan was done in. If they did not routinely ask for a CT scan, they were asked for what percentage of patients they did ask for a CT scan, and the main reason for not requesting a scan. Further questions were asked about the CT scanner hours of work, how far away the scanner was, the mechanism of requesting the scan, how the patient was taken to the scanner, how the result of the scan reached the referring doctor, the level of satisfaction with the CT service, and how it might be improved.

All the questions were exactly translated from English to Italian by the Italian IST co-ordinator, apart from one concerning the

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**Table 1** Differences in the wording of Italian and UK versions of the one question which was not translated verbatim into Italian

Part of question	UK	Italy
a	Junior doctor asks radiologist who says Yes/No	The doctor on call asks the radiologist, who can refuse
b	Senior doctor asks radiologist who says Yes/No	One of the consultants, or the head of department, asks the radiologist, who can refuse
c	Junior doctor asks radiographer (technician) - no involvement of radiologist	There is a direct request to the radiographer, without talking to the radiologist
d	Nurse or other non-medical person asks radiologist	If the request is made by the doctor on call, the CT is always done
e	Nurse or other non-medical person asks radiographer (technician)	If the request is made by one of the consultants, or the head of department, the CT is always done

The question asked was 'How do you get a CT scan? (circle one or more as appropriate)'. The possible responses (a to e) are shown in this table.

mechanism for requesting the scan (table 1). This question was adapted by the Italian IST co-ordinator to reflect better the way CT scans are requested in Italy and it was only possible to compare part of the Italian responses with the UK responses. For example, it was only possible to examine the effect of nurses requesting a scan within the UK, as nurses are not allowed to request CT scans in Italy, and the Italian IST co-ordinator did not feel it appropriate to ask this part of the question in Italy.

The questionnaire data from each hospital were cross-referenced with data from the IST main trial data set on the mean time to randomisation with a CT scan in that hospital. Appropriate statistical tests to examine between-country differences were performed using SAS for windows version 6.12 (SAS Institute Inc, Cary, NC 27513, USA), and these are described in the footnote to table 2. Minitab's generalised linear model procedure (Minitab for Windows release 11, Minitab Inc, State College, PA 16801-3008, USA) was used to investigate factors affecting times to randomisation within each country. Only the

responses appropriate to handling IST patients were included in the analysis as no significant differences were found between CT scanning practices for IST and non-IST patients.

## Results

One hundred and twenty of the 179 (67%) hospitals in the UK and Italy who had randomised patients into the IST and performed at least one pre-randomisation CT scan responded to the questionnaire. There was a small but non-significant difference between the two countries with 47 of the 76 Italian hospitals responding (62%), compared to 73 of the 103 UK hospitals (71%) (chi-squared test,  $p=0.2$ ). The median number of patients randomised with CT amongst the responding hospitals was 34, compared to 17 in the non-responding hospitals (Wilcoxon signed-rank test,  $p<0.001$ ). The mean time to randomisation with CT was 23 hours for responders and 25 hours for non-responders (t-test  $p=0.4$ ).

For responders, the mean time to randomisation with CT was 18 hours in Italian hospitals

**Table 2** Features of UK and Italian IST hospitals

	Italy n (%)	UK n (%)	Total n (%)	p-value
<i>On what percentage of your stroke patients do you get a CT scan done?</i>				
100% scanned	42 (89)	44 (63)	86 (74)	
80–90% scanned	4 (9)	18 (26)	22 (19)	0.001
60–70% scanned	1 (2)	6 (9)	7 (6)	(*)
50% or less scanned	0	2 (3)	2 (2)	
Missing	0	3	3	
<i>If you scan all your patients, within how long do you ask that it is done?</i>				
Within 6 hours	19 (46)	2 (5)	21 (26)	
Within 12 hours	4 (10)	3 (7)	7 (9)	
Within 24 hours	10 (29)	13 (32)	23 (28)	<0.001
Within 48 hours	5 (12)	10 (24)	15 (18)	(*)
Within a week	3 (7)	13 (32)	16 (20)	
Missing	1	3	4	
<i>At what times does your CT scanner work?</i>				
All the time	34 (77)	29 (40)	63 (54)	
During normal working hours and at weekends, but not at night	4 (9)	13 (18)	17 (15)	<0.001
Only during normal working hours Mon–Fri	6 (14)	31 (42)	37 (32)	
Missing	3	0	3	
<i>How do you get a CT scan? (Circle one or more as appropriate)</i>				
Junior doctor asks radiologist	32 (68)	43 (59)	75 (63)	0.3
Senior doctor asks radiologist	15 (32)	26 (36)	41 (34)	0.7
Request from doctor can go directly to radiographer (technician) - no involvement of radiologist	6 (13)	28 (38)	34 (28)	0.002
Nurse can request a scan		4 (5)		
<i>How do your patients get to the CT scanner?</i>				
Very close - a doctor or nurse takes the patient	20 (43)	9 (13)	29 (25)	
A hospital porter has to do it	15 (32)	48 (68)	63 (53)	<0.001
Ambulance	12 (26)	14 (20)	26 (22)	
Missing	0	2	2	
TOTAL	47 (100)	73 (100)	120 (100)	

P-values are from Chi-squared tests, except where marked (\*), which are from Wilcoxon signed rank tests.

and 27 hours in the UK (t-test  $p < 0.001$ ). The following features of Italian CT scanning services may have made them more efficient than UK CT scanning services (table 2):

- Italian hospitals scanned a larger proportion of patients, and asked for scans to be done within a shorter time deadline than UK hospitals
- 77% of Italian hospitals had a 24-hour CT scanning service available compared with 40% of UK hospitals
- 13% of Italian hospitals could request a scan directly from the CT radiographer, compared to 38% of UK hospitals (although one might expect that by-passing the radiologist would hasten the scan)
- the proportions of patients transported to the scanner by a doctor or nurse, a porter, and by ambulance differed significantly between Italy and the UK (chi-squared test,  $p < 0.001$ ). In 68% of UK hospitals a porter was used to transport the patient to the CT scanner compared with only 32% of Italian hospitals. Similar proportions of UK and Italian hospitals required an ambulance to get from the ward or emergency department to the scanner.

The distance to the scanner and whether a nurse had to accompany the patient from the ward or emergency department appeared to be similar between Italy and the UK.

Thirty (64%) Italian hospitals were satisfied with their CT scanning service, compared to 33 (46%) UK hospitals (chi-squared,  $p = 0.06$ ). The most common reasons for dissatisfaction in the UK were that the CT scanner was not available 24 hours a day, 7 days a week, and that scans were not done quickly enough.

The above factors were examined to see if they affected times to randomisation with a CT scan within either country. No factors were significant at the 5% level, but the sample size was fairly small. However, within the UK, the effect of allowing a nurse to request a scan approached significance (t-test,  $p = 0.07$ ), with hospitals that allowed nurses to request scans taking 22 hours (SD 4.5 hours) on average to randomise patients with a CT scan compared to 27 hours (SD 5.6 hours) in hospitals who did not allow nurses to request a CT scan.

## Discussion

In the UK, the hospitals participating in the IST took 50% longer to randomise patients with a CT scan than the Italian hospitals. In both countries the participating hospitals included a wide range of teaching and district general hospitals which were of varying size and served varying populations. The hospitals are therefore reasonably representative of hospitals in the two countries. Although there may be cultural differences between Italy and the UK that cause CT scanning to occur faster in Italy, it is probable that having a scanner working 24 hours per day, not waiting for a porter to take the patient (ie, the doctor or nurse takes the patient), and asking for, or expecting, scans to be performed more quickly would improve CT scanning times. Hospitals

admitting stroke patients may be able to speed the time to CT by a few simple changes in how the scan is organised.

The IST is the largest ever acute stroke trial with 3165 patients randomised within 6 hours, and yet was conducted in a very pragmatic fashion. The UK and Italy were by far the most active countries in the IST, between them contributing 8902 patients (46%). The next most active countries were Switzerland (1631 patients in 39 hospitals), Poland (759 patients in seven hospitals) and The Netherlands (728 patients in 10 hospitals). The organisation of CT services for stroke within the participating hospitals is not only very relevant for those interested in improving stroke services, but it is likely to be generalisable to other hospitals caring for stroke patients

The 67% response rate to the questionnaire is quite good for a postal survey with no reminders. We think that it is unlikely that our results have been biased by non-response, as the mean time to randomisation with CT among the responders was not significantly different from that among the non-responders. It is, however, likely that we have sampled the larger, more efficient centres.

Italian doctors expected their CT scans to be done more quickly, and to be done before randomisation in a larger proportion of patients. Perhaps doctors are too reserved in the UK, or perhaps this is a reflection that, in the UK, CT is still regarded as a scarce resource. In Italy, CT services may be more abundant. In Italy glycerol is frequently used to treat ischaemic, but not haemorrhagic stroke, so that it is often imperative to get a CT scan done quickly. In the UK, although more hospitals now have their own CT scanners, they often only operate between 09.00 h and 17.00 h. Dorman and Sandercock<sup>3</sup> found that only 25% of UK accident and emergency departments could get easy access to CT scanning for stroke patients outside normal working hours, although a further 44% could get access with some difficulty. Only 52% of UK accident and emergency departments could get easy access to CT scanning for stroke patients within normal working hours. Lindley *et al*<sup>1</sup> found that only 47% of consultants could get access to CT scanning services 24 hours a day, 7 days a week, and that only 32% could get their stroke patients CT scanned within 2 days. The process of requesting a CT scan seems similar in the two countries, except that in the UK one can more often by-pass the radiologist and go straight to the radiographer. However, one would expect the latter to speed up rather than slow down access to CT as the technician in the scan room should be more accessible than the radiologist who may be covering other parts of the radiology department. It is no surprise that waiting for a hospital porter slows down the process of CT scanning. An extra phone call and the wait for the porter to arrive adds to the journey time. In addition, the porter may have less of a sense of urgency than a doctor or nurse and may be subject to many competing demands so may not be able to attend instantly. Surprisingly, having to use an ambulance to move the

patient from the receiving unit to the CT scanner did not significantly slow down the scanning process.

Thus, there are a few simple factors which could speed up access to a CT scanner: not waiting for a porter, encouraging more stroke patients to be scanned and at shorter deadlines, and ensuring a 24-hour CT service. Access to CT will certainly need to improve if new treatments like thrombolysis are ever to be widely implemented.

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- 1 Adams HP, Brott TG, Furlan AJ, *et al.* Guidelines for thrombolytic therapy for acute stroke: a supplement to the guidelines for the management of patients with acute ischaemic stroke. A statement for healthcare professionals from a Special Writing Group of the Stroke Council, American Heart Association. *Stroke* 1996;**27**:1711–8.
- 2 International Stroke Trialists Collaborative Group. The International Stroke Trial (IST): a randomised trial of aspirin, subcutaneous heparin, both, or neither among 19435 patients with acute ischaemic stroke. *Lancet* 1997;**349**: 1569–81.
- 3 Dorman P, Sandercock P. Access to computed tomography in British accident and emergency departments (Letter). *BMJ* 1997;**314**:440–1.
- 4 Lindley RI, Amayo EO, Marshall J, Sandercock PAG, Dennis M, Warlow CP. Hospital services for patients with acute stroke in the United Kingdom: the stroke association survey of consultant opinion. *Age Ageing* 1995;**24**:525–32.