Key messages

- In an experimental regional trauma system in the North West Midlands region the trauma centre was provided with 24 hour cover by consultants in accident and emergency and additional resources for intensive care
- We assessed the effect of the regional trauma system on the survival of patients with major trauma
- There was little evidence of the development of an integrated trauma system, and the proportion of patients taken directly to the trauma centre increased only for those with multiple injuries
- There was no reliable or consistent evidence that these developments improved patients' chance of survival from major trauma in the region
- Possible benefits from regionalising trauma care in shire areas of England are probably modest compared with claims from the United States

We are grateful to the staff at the North Staffordshire Royal Infirmary, who cooperated so wholeheartedly: Professor J Templeton, Mr D McGeehan, Dr P Morrison, Dr P Oakley, Mr I Phair, Mr M Prescott, Professor A Redmond, Miss A Cook, Mr S Davies, and Mrs D Griffiths. We are grateful for the help and cooperation of the accident and emergency consultants at the other hospitals in the trauma system and comparator regions: Mr S Al-Atrakchi, Mr J Bache, Mr T George, Mr N Goel, Mr S Goode, Dr J Gosnold, Mr P Grout, Mr N Harrop, Mr M Hockey, Mr M James, Mr A Kumar, Mr A Leaman, Mr A Lester, Mr M McColl, Dr R McGlone, and Mr F O'Dwyer. We also thank the coroners offices in each of the three regions for their help and support.

Funding: This work was undertaken by the Medical Care Research Unit, which is supported by the Department of Health. The views expressed here are those of the authors and not necessarily those of the department.

Conflict of interest: None.

1 Royal College of Surgeons of England. *The management of patients with major injuries.* London, RCS, 1988.
2 American College of Surgeons Committee on Trauma. *Resources for optimal care of the injured patient.* Chicago: American College of Surgeons, 1990.
3 Cales RH. Trauma mortality in Orange County: The effect of implementation of a regional trauma system. *Ann Emergency Med* 1984;13:1-10.
4 Lowe DK, Gately HL, Goss R, Frey CL, Peterson CG. Patterns of death, complication and error in the management of motor vehicle accident victims: Implications for a regional system of trauma care. *J Trauma* 1983;23(6):503-7.
5 Shackford SR, Hollingsworth-Fridlund P, Cooper GF, Eastman AB. The effect of regionalisation upon the quality of trauma care as assessed by concurrent audit before and after the institution of a trauma system: a preliminary report. *J Trauma* 1986;26:812-20.
6 Guss DA, Meyer FT, Neuman TS, Baxt WG, Dunford JV, Griffith LD, et al. The impact of a regionalised trauma system on trauma care in San Diego County. *Ann Emergency Med* 1989;18:1141-5.
7 Baker SP, O'Neill B, Haddon W, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma* 1974;14:187-96.
8 Association for the Advancement of Automotive Medicine. *The abbreviated injury scale. 1990 revision.* Des Plaines: Association for the Advancement of Automotive Medicine, 1990.
9 Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. *J Trauma* 1987;27:370-8.
10 Yates DW, Woodford M, Hollis S. Preliminary analysis of the care of injured patients in 33 British hospitals: first report of the United Kingdom major trauma outcome study. *BMJ* 1992;305:737-40.
11 Bull JP, Dickson GR. Injury scoring by TRISS and ISS/age. *Injury* 1991;21(2):127-31.
12 Myers RA. Advanced trauma life support course [editorial]. *J R Soc Med* 1990;83:281-2.
13 Zoltie N, deDombal FT. The hit and miss of ISS and TRISS. *BMJ* 1993;307:906-9.
14 Nicholl JP, Turner J, Dixon S. *The cost-effectiveness of the regional trauma system in the North West Midlands.* Sheffield: Medical Care Research Unit, University of Sheffield, 1995.
15 Rutledge R, Messick J, Baker CC, Rhyne S, Butts J, Meyer A, et al. Multivariate population-based analysis of the association of county trauma centers with per capita county trauma death rates. *J Trauma* 1992;33(1):29-38.
16 Cales RH, Trunkey DD. Preventable trauma deaths: a review of trauma care systems development. *JAMA* 1985;254:1058.
17 Cambell S, Wattans G, Kreis D. Preventable deaths in a self-designated trauma system. *Am Surg* 1989;55:478-86.
18 Cayten E, Stahl W, Ararwal N, Murphy J. Analyses of preventable deaths by mechanism of injury in 13,500 trauma admissions. *Ann Surg* 1991;214(4):510-20.
19 Roy PD. The value of trauma centres: a methodological review. *Can J Surg* 1987;30:17-22.
20 Kane G, Wheeler NC, Cook S, Englehardt R, Pavey B, Green K, et al. Impact of the Los Angeles County trauma system on the survival of seriously injured patients. *J Trauma* 1992;32:576-83.
21 Mullins RJ, Veun-Stone J, Hedges JR, Zimmer-Gembeck MJ, Mann NC, Southard PA, et al. Influence of a statewide trauma system on location of hospitalization and outcome of injured patients. *J Trauma* 1996;40:536-45.
22 Redmond A, Johnstone S, Maryosh J, Templeton J. A trauma centre in the UK. *Ann R Coll Surg Engl* 1993;75:317-20.

(Accepted 21 October 1997)

Effect of a strict HLA matching policy on distribution of cadaveric kidney transplants to Indo-Asian and white European recipients: regional study

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BMJ 1997;315:1354–5

The matching of donor and recipient for HLA type is an important factor in determining the survival of kidney grafts.[1] Our unit participates in national and regional organ sharing schemes and allocates locally donated kidneys according to HLA matching. Consequently only 2% of our transplants have had two mismatches for HLA-DR. This policy could put patients whose HLA types differ from those in the donor population at a disadvantage.[2]

In this study we measured the rates of end stage renal failure, kidney donation from cadavers, and kidney transplantation in the white European and Indo-Asian populations of Coventry and Warwickshire.

Patients, methods, and results

Data on the adult population in Coventry and Warwickshire were obtained from the 1991 national census. Patient records from 1988 to 1995 inclusive were examined to determine the patient's place of residence. The ethnic group of patients was identified by surname and by the ethnic group declared at the time of registration at the hospital. We included only Indo-Asian and white European patients in the study. The definition of beneficial HLA matching was that used by the United Kingdom Transplant Support Service Authority. Statistical analysis was by the χ^2 test and Student's t-test as appropriate.

Dialysis and transplantation in white European and Indo-Asian patients in Coventry and Warwickshire, 1988-1995. Values are proportions (percentages) of patients unless otherwise indicated

	European (n=597 046)*	Indo-Asian (n=26 869)*	P value
Receiving dialysis			
No of patients	395	71	
Rate†	82.6	330.3	<0.001
On waiting list for transplant			
Receiving dialysis	254/395 (64)	51/71 (72)	NS
Mean (SD) age (years)	48.2 (14.4)	47.5 (14.2)	NS
No (%) male	148 (58)	31 (61)	NS
Rate†	53.1	237.2	<0.001
Transplantation			
Recipients:			
On waiting list	176/254 (69)	21/51 (41)	<0.025
Beneficial HLA match	39/176 (22)	3/21 (14)	NS
Rate†	36.8	97.6	<0.001
Donor kidneys:			
No of kidneys	192	2	
Rate†	40.1	9.3	<0.025
Outcome:			
Graft survival (years):			
1	122/157 (78)	16/19 (84)	NS
3	99/138 (72)	11/15 (73)	NS
Patient survival (years):			
1	144/157 (92)	18/19 (95)	NS
3	120/138 (87)	13/15 (87)	NS
Transplant survival (years):			
1	127/144 (88)	17/18 (94)	NS
3	102/120 (85)	11/13 (85)	NS

*Adult population of Coventry and Warwickshire.
†Per million population per year.

No difference was seen between the proportions or ages of white European and Indo-Asian patients receiving dialysis who were placed on a waiting list for transplant surgery (table). Thirty three per cent (17/51) of Indo-Asian patients and 19% (48/254) of white European patients remained on waiting lists for more than 2 years without receiving a transplant ($P < 0.025$). The rate of organ donation was considerably lower in the Indo-Asian population than in the white European population: 40.1 kidneys donated per million population per year among white Europeans compared with 9.3 among Indo-Asians.

As expected, the Indo-Asian patients had a different distribution of blood groups—a higher frequency of groups B and AB and a lower frequency of group A. The proportion of Indo-Asian patients in each blood group who received transplants was lower than the proportion of white Europeans; this difference was most obvious for blood group O, in which 63 out of 117 (54%) white Europeans received transplants compared with 2 out of 14 (14%) Indo-Asian patients.

Comment

Our results confirm that proportionately more Indo-Asian patients than white European patients both start dialysis and wait for a kidney transplant.[3] Our policy for the distribution of grafts resulted in similar proportions in each ethnic group receiving grafts beneficially matched for HLA: 22% of white Europeans and 14% of Indo-Asians. Therefore, our results do not seem to be caused by bias in the selection of patients for transplantation or in the distribution of grafts.

We believe that Indo-Asian patients should not be denied access to renal transplantation because there is a low rate of organ donation from their ethnic group. The factors that may account for the low rate of donation among Indo-Asian patients include the age distribution of the Indo-Asian population, the low number of Indo-Asians admitted to intensive care units, and religious views about organ donations from cadavers.

So long as organs for transplantation are scarce, a strong argument can be made for the allocation of kidneys solely to achieve the best possible graft survival; this is the current policy used by the United Kingdom Transplant Support Services Authority. This is also the policy that we have used previously.

Since June 1996, after the end of our study, we have altered our policy for the allocation of kidneys: regardless of ethnic origin all patients who have been on the waiting list for more than 2 years may be offered a kidney on the basis of a HLA-DR0 or HLA-DR1 match whatever the HLA class 1 matching (as long as the HLA-A2 and the HLA-B5 group are not mismatched). In this way we hope to improve access to transplantation while maintaining some advantage from HLA matching.

Funding: None.
Conflict of interest: None.

1 Takiff H, Cook DJ, Himaya NS, Mickey MR, Terasaki PI. Dominant effect of histocompatibility on 10 year kidney transplant survival. *Transplantation* 1988;45:410-15.
2 Gaston RS, Ayres I, Dooley LG, Diethelm AG. Racial equality in renal transplantation. *JAMA* 1993;270:1352-6.
3 Higgins RM, Edmunds ME, Dukes DC. Incidence of end-stage renal failure in Indo-Asians. *Q J Med* 1995;89:522-3.

(Accepted 10 April 1997)

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A memorable patient

Trip from Africa

As a medical resident my chief always drummed into me that patients do not just trip and fall downstairs; the "trip" is often triggered by an underlying condition or event such as a fainting spell or gait disturbance. Years later, during a period of pathology training, this dictum acquired special significance.

A middle aged man, in previous good health, was brought to the emergency department with a history of having tripped on the stairs and knocked himself unconscious. He was examined, found to be essentially in good health, had an *x* ray examination to rule out a skull fracture, and was discharged home. The following day, he was readmitted in a coma and died within hours. A more detailed history revealed that he had worked in Africa and recently returned from there. A blood film was loaded with malarial parasites literally from head to toe. A necropsy identified the cause of death as cerebral malaria.

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We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake,* or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk.