JOURNAL SCAN

Journal scan

Edited by Jim Wardrope; this scan coordinated by Thomas Carrigan

Systematic review of published evidence regarding trauma system effectiveness

N Clay Mann, R J Mullins, E J MacKenzie, *et al*

J Trauma 1999;47: (suppl):25–33

Objective—To provide a systematic review of the published literature assessing the effect of trauma centre/system implementation on patient outcomes.

Methods—A search of Medline, HealthSTAR, and CINAHL yielded 245 papers with 39 additional manuscripts identified by references of reviewed manuscripts. Literature was restricted to United States and Canadian studies. The strength of evidence associated with each article was critically appraised by a three tier classification system developed to assess the traumatic brain injury literature. Class I studies were prospective randomised controlled trials. Class II studies were well designed prospective or retrospective controlled cohort studies, or case-control studies. Class III studies were other quasi-experimental studies that use existing databases, registries, or relied on case series data.

Results—42 papers were included in the critical appraisal review. This review found mainly Class III evidence, which consisted of three different study types; “Panel studies” used expert panels to determine whether trauma systems are effective in reducing preventable death. The authors pointed out a number of possible sources of bias in this methodology including the use of local assessors with knowledge of the system, lack of blinding to the centre of treatment (trauma centre or not), and the varying quality of injury information of necropsy reporting. “Comparisons to National injury registries” used mostly Major Trauma Outcome Study (MTOS) methodology to examine numbers of expected deaths against numbers of observed deaths. However, there were inconsistencies with data collection protocols, case mix and injury demographics and criticisms that MTOS data are not population based. This led to the authors classifying such comparisons as Class III evidence. “Population-based studies” used larger databases, including claims and vital statistic data, which permitted trauma system assessment within an entire region or state, commonly using pre-system versus post-system, or trauma centre versus non-trauma centre comparisons. The authors considered these studies provided the most robust evidence. Unfortunately,

incomplete data collection, bias in coding for claiming treatment reimbursement, and bias in focusing on outcome of the most severely injured led to such studies also being classified as Class III evidence.

Summary of evidence—“Panel studies” demonstrated a reduction in the number of preventable deaths of up to 50% with increasing commitment to trauma care resources and expertise. Registry comparisons show a uniform 15% reduction in mortality, when compared with MTOS norms. Population-based studies, incorporating multivariate modelling to control for covariables, demonstrated a 15–20% reduction in the risk of death after trauma system implementation.

Comments—This study is a good review of the North American evidence on the impact of a trauma system on deaths. The authors’ opinion was that much of the evidence is not of the most robust type as judged by current standards. However, it would be very difficult to perform a randomised controlled trial of this type of massive systems change. Some of the cohort studies might be considered by many as providing quite high level evidence. The authors are probably correct that some kind of population based survey of deaths and serious disability is the way forward in this type of research. The economic dimension is also important, especially in the context of a cash limited National Health Service.

Care of minor injuries by emergency nurse practitioners or junior doctors: a randomised controlled trial

M Sakr, J Angus, J Perrin, *et al*

Lancet 1999;354:1321–6

Objectives—To compare the assessment and treatment of patients with minor injuries managed by emergency nurse practitioners (ENP) or accident and emergency (A&E) senior house officers (SHO). The primary outcome measure was the adequacy of care provided, which included history taking, examination of patient, interpretation of radiographs, treatment decision, advice, and follow up arrangements. Secondary outcomes included patient satisfaction, improvement, return to usual activity, and need for unplanned follow up.

Methods—Patients presenting to an A&E department were randomised to receive care from either an ENP or SHO. The patient was seen by a research registrar who filled out a proforma designed to be as close to a “gold

Accident and
Emergency
Department, Northern
General Hospital,
Herries Road,
Sheffield S5 7AU
J Wardrope

St James’s University
Hospital, Leeds
T Carrigan

Correspondence to:
Mr Wardrope, Associate
Editor (e-mail:
jimwardrope@hotmail.com)

standard" of management as possible. The clinical notes were transcribed to blind the comparison of the ENP/SHO initial assessment versus research proforma. The adequacy of management was classified as "same", "clinically not important", "clinically important", or "clinically very important". Radiography reports were used to compare radiological interpretation. Patients were sent a postal questionnaire at 28 days to assess outcome. Cost comparisons were made by evaluating costs of investigation, follow up, employment costs, and assessment time between the two groups.

Results—Groups were mostly comparable at the start apart from a higher proportion of men in the ENP group (72.4% *v* 65.4%). There was no significant difference between ENPs and SHOs in accuracy of examination, requests for radiography, adequacy of treatment, 28 day outcome, or patient satisfaction. ENPs were better at recording past medical history (76% *v* 55%), but they took longer to assess the patients and record the findings (10.89 *v* 9.04 minutes; *p* = 0.04). Fewer patients seen by ENPs had the need for unplanned follow up (8.6% *v* 13.1%; *p* = 0.03). Cost comparisons showed that ENPs were more expensive per hour than SHOs, when out of office hours are taken into consideration.

Conclusions—Properly trained A&E nurse practitioners, who work within agreed guidelines, can provide care for patients with minor injuries that is equal or in some ways better than that provided by junior doctors.

Comment—The methods seemed appropriate. The introduction of a separate research assessment may have changed patient or clinician behaviour. An intention to treat analysis was not performed, but otherwise the statistics were appropriate for the comparisons. Attempts were made to blind assessments. The A&E consultant reviewed all the cases to independently assess the adequacy of care. There was no measure of interobserver variability. The results are encouraging, but one also needs to assess the cost of training ENPs. This trial was carried out in an A&E department. The costs of ENPs working in a minor injury unit may be greater because of the cost of transferring to other sites when the patients presenting condition does not fit the limited scope of ENP practice. Future studies may blind the patient to the treating clinician, increase numbers to improve statistical power, measure agreement between assessors, and make a more thorough assessment of cost effectiveness. While supporting the case for ENPs, cost implications, together with ENPs' limited scope of practice, must be considered in departmental workforce planning.

A cumulative meta-analysis of the effectiveness of defibrillator-capable emergency medical services (EMS) for victims of out of hospital cardiac arrest

G Nichol, I G Stiell, A Laupacis, *et al*
Ann Emerg Med 1999;34:517–25

This study assessed the relative effect of bystander cardiopulmonary resuscitation, re-

sponse time interval to defibrillation, and type of EMS system on survival after out of hospital cardiac arrest. Survival to hospital discharge was significantly associated with bystander cardiopulmonary resuscitation, a decrease in the response time to defibrillation (especially from 11 to 7 minutes), and the more advanced type of EMS system (ALS or two tiered system).

Comment—This study improves on current evidence to support pre-hospital cardiac care. Studies were limited to the English language, and no attempts were made to consult experts for additional or unpublished, possibly negative studies. The meta-analysis supports the need for strong links in the chain of survival. Future meta-analysis should widen the search strategy. Valid evidence should be based on reproducible data collection as advocated by the Utstein guidelines. Appropriate study design should consider publication bias and potential confounders such as intensive care utilisation and pre-existing disease. Outcome measures should include survival at 30 days and quality of life beyond discharge.

Long-term benefit of primary angioplasty as compared with thrombolytic therapy for acute myocardial infarction

F Zulstra, J C A Hoorntje, M J De Boer, *et al*
N Engl J Med 1999;341:1413–19

This study reports the long term outcome of patients enrolled in a randomised controlled trial of primary angioplasty (*n* = 194) compared with thrombolysis (*n* = 201) in acute myocardial infarction. The groups were similar in demographic and prognostic factors before treatment. The patency rates at follow up angiography were significantly better in the primary angioplasty group compared with the thrombolysis group (90% *v* 65%; *p* < 0.001). In the angioplasty group, a significantly lower rate of death (13% *v* 24%; *p* = 0.01) was found. Angioplasty was also associated with less non-fatal re-infarction than with thrombolysis (6% *v* 22%), mainly within 30 days but also at long term follow up. Left ventricular function was better after primary angioplasty, as judged by better ejection fractions and less re-admission rates for heart failure. Patients were also taking less cardiac medications after angioplasty compared with the thrombolysis group, possibly reflecting more cardiovascular morbidity in the thrombolysis group.

Comment—The major improvement in mortality and re-infarction rates in the angioplasty group occurred before 30 days. There was a trend to improving mortality in the angioplasty group between 30 days and final follow up (two to five years). Greater numbers would be needed to provide statistical power to prove a difference in mortality in the period from 30 days to long term follow up. A devil's advocate might suggest 24 hour availability of angioplasty services, based on the accumulating evidence of benefit. However, the NHS has neither the equipment nor the resources to provide this. Applicability is limited and cost effectiveness studies will be needed to convince the majority.

Ultrasonography and limited computed tomography in the diagnosis and management of appendicitis in children

B M Garcia Pena, K D Mandl, S J Kraus, *et al*
JAMA 1999;282:1041–6

This study prospectively analysed the use of ultrasound followed by computed tomography with rectal contrast (CTRC) when necessary, in the diagnosis of equivocal appendicitis in children and adolescents aged 3 to 21 years ($n=139$). Findings were that the US/CT protocol used to evaluate equivocal appendicitis was 96% sensitive and 94% specific, with a positive predictive value of 90% and a negative predictive value of 97%. Conclusions were that CTRC following a negative or indeterminate ultrasonography result is highly accurate in the diagnosis of appendicitis in this population. The authors suggested that these investigations should be reserved for those children in whom, after full clinical evaluation, the diagnosis remains uncertain. Ultrasonography, despite lower diagnostic yield should be used first because of its speed and safety. CTRC should be used in patients with equivocal clinical findings and equivocal ultrasound. This approach clearly needs further practical and economic evaluation but may be one approach to this difficult area of clinical decision making.

Use of an objective structured clinical examination OSCE for the assessment of physician performance in the ultrasound evaluation of trauma

A C Sisley, S B Johnson, W Erickson *et al*
J Trauma 1999;47:627–31

This study set out to assess physician performance in a focused abdominal sonography in trauma (FAST) course. Entry criteria excluded those with previous ultrasound experience, and they were assessed by a specifically designed OSCE, which consisted of multiple choice and data interpretation questions both before and after the course. While there was significant improvements in post-course OSCE scores, this was better for factual multiple choice knowledge than interpretation skills. Unfortunately the OSCE questions were the same before and after the test, and the OSCE was not validated in an appropriate population of experienced ultrasonographers. The OSCE in this study only tested two components of FAST competency. The other two and perhaps more important components being technical skill in image acquisition and incorporation of findings into rational treatment planning.

Adult versus paediatric prehospital trauma care: is there a difference?

T R Paul, M Marias, P T Pons, *et al*
J Trauma 1999;47:455–9

This retrospective review compared paramedic's assessment and management of paediatric versus adult trauma patients as reflected by cannulation, intubation, and survival. Medical records of 232 paediatric (age 0–12) and 3375 adult patients, treated for trauma at a Level I trauma centre, were stratified into three Injury Severity Score subgroups (1–15, 16–25, >25), and compared using a statistical pack-

age. Findings showed that there was a higher proportion of paediatric patients (91.8% *v* 85.6%) in the minor trauma group (ISS 1–15). There was also a significantly higher proportion of penetrating trauma in adult patients. Response times and times at scene were similar for paediatric and adult trauma groups, but slower return times mean (SD) (8.2 (3.7) min *v* 7.4 (4.3) min; $p = 0.005$). Adult patients were more likely to be intubated (4.1% *v* 0.5%; $p = 0.004$) and cannulated (86.1% *v* 70%; $p < 0.001$) in minor trauma groups (ISS 1–15) than paediatric patients. The increase in intubation rate after minor trauma for adults is partially explained by a postulated increased incidence of alcohol intoxication. Paramedics were able to intubate and cannulate both paediatric and adult patients with statistically similar success rates. Cannulation did not increase time at scene in adults nor children, but intubation increased time at scene by an average 60–90 seconds for both groups. With respect to survival to discharge, there was no significant difference in survival between adult and paediatric groups in minor and major trauma. It was stated that the paediatric group were more likely to survive (100% blunt/50% penetrating *v* 40.4% blunt/12.9% penetrating; $p = 0.07/0.04$) in severe trauma. This was not significant at their set p value of 0.05.

Predicting concentrations in children presenting with acetaminophen overdose

B J Anderson, N H G Holford, J C Armishaw, *et al*
J Pediatr 1999;135:290–5

This study was to verify a pharmacokinetic model of plasma paracetamol concentration using retrospective information from 121 children with paracetamol ingestion. Data collected included the age of the child, dose ingested and plasma paracetamol concentration. The models were used to predict time concentration curves for 1 year old, 5 year old, and adult subgroups. These predictions were then validated by comparison with paracetamol concentrations obtained at four hours from the 121 children with accidental overdose. The models tended to predict higher concentrations than were observed. However, the models predicted that the maximum paracetamol concentrations occurred at two hours (in 95% of simulated children). Reasoning for this was that young children have short absorption half lives and an earlier peak time. Adults have longer absorption half lives resulting from the form taken (elixir is absorbed more quickly than tablets) and other self administered medications that delay gastric emptying. A side study examined the effect of charcoal administration on serum paracetamol concentrations, which was given to 66 of the 121 patient validation cohort. They concluded that neither the use nor the timing of charcoal had any apparent effect on paracetamol concentration. The major conclusion of the study was that in children aged 1 to 5 years with a reported ingestion of >250 mg/kg paracetamol elixir, early concentration measurement at two hours after ingestion is recommended, rather than

four hours as recommended in adults. This contrasts with poisons advice in the United Kingdom, which suggests four hour levels after >150 mg/kg. The Rumack-Matthew toxicity nomogram that we use to guide treatment for adults and children was based on 30 adult patients. Clearly this might have important applications but much more evidence is required before adopting the authors' recommendations.

Is bigger better? Concentration in the provision of secondary care

J Posnett

BMJ 1999;**319**:1063–5

This article, part of a series on the hospital of the future, clarifies the evidence. Managers feel that merging trusts or rationalising services will

reduce costs, and clinicians feel that by concentrating services, volume of patient contact will improve patient outcomes. The evidence from research, however, “does not support any general presumption that larger hospitals benefit from economies of scale or that service concentration leads to improved outcomes for patients”. It is suggested, that based on current evidence, the optimal size for hospitals ranges from 200 to 400 beds. Trust mergers have already made an impact on the provision of emergency medicine and trauma care. The author feels that primary care groups will have more say in the future, and local accessibility may have a greater priority. Future planning should ensure that the way forward is evidence-based as well as cost effective. Or has the gate been shut too late?