Vol 3 No 4 May-July 2002

Contents:

TRAUMA Grapevine

Introduction

In this issue we are pleased to have a review of recidivism and the use of external fixators for control of pelvic haemorrhage in haemodynamically unstable patients. The accompanying editorial and article provide an insight into the lack of strong scientific evidence favouring modalities currently used in haemorrhage control in patients with major pelvic trauma. This indicates the need for a broader generation of clinical practice guidelines for the management of complex life threatening pelvic trauma.
Michael Sugrue

Recidivism -

Is it a real problem in an Australian Major Trauma Service?

Elizabeth Anne Cross, Scott D'Amours, Michael Sugrue
Trauma Department, Liverpool Hospital

INTRODUCTION

Trauma recidivists are patients who are admitted on more than one occasion following trauma.

Trauma recidivism is a major problem for some patients, our communities[1]. Characteristics of recidivists presenting to a trauma service have been identified. These can vary dependant on the population demographics[2,3,4,5] as can the incidence of recidivism itself[2].

It has been postulated that the incidence of recidivism can be reduced by appropriate interventions[3,4,6,7]. Previous evaluation of recidivism at a Major Trauma Service has not been undertaken. The aim of this study was to determine the number and characteristics of recidivists using the trauma service at Liverpool Hospital, NSW.

METHODS

Liverpool Hospital serves a population in excess of 750,000 people and is the designated Major Trauma Service for south-west Sydney. This review was undertaken between September 1994 and March 2001. A trauma registry has been in existence for the last 7 years and provides a record of all trauma admissions. At the time of the study this totalled 12, 408. The registry has two core data collection categories, major and minor. The Injury Severity Score (ISS) is not recorded for minor injuries and therefore the average ISS could only be calculated for the admissions in the major injury category.

Recidivists were identified from the registry as patients whose medical record number (MRN) appeared more than once. The age, gender and date of presentation were retrieved from the database, as was the mechanism of injury and the ISS (major presentations only).

Mechanisms of injury were classified under road trauma, interpersonal violence, industrial, recreation, falls and others.

The number of recidivists was compared to the total number of admissions recorded in the registry during its existence. The gender and age distribution of recidivists was analysed. The mechanism of injury at the first presentation was compared to that at the subsequent admission.

Results

This study identified 289 patients, with multiple presentation accounting for 600 admissions, who were admitted to Liverpool Hospital because of trauma between the 1st September, 1994 and 30th March, 2001. This represents 2.3% of all trauma admissions. The mean age at presentation was 43 years and ISS was 10.2 ±8.2

Males accounted for 191 of 289 (66%) and 98 (34%) were female. The age distribution is shown in figure 1. The majority of recidivists presented only twice (94%) with 5% and 1% presenting three and four times respectively.

Continued next page

Recidivism - Is it a real problem in Australian Major Trauma Service?

Continued

The mechanism of injury at each admission was the same in 52% of cases (n = 151). The repeat mechanism involved is illustrated in figure 2. Figure 3 illustrates this data with respect to age group.

Discussion

Trauma recidivists at Liverpool Hospital account for 2.3% of trauma admissions. This is comparable to the incidence found in Nevada[2] but lower than the 6.3% cited for a Californian urban trauma centre[8]. It should be noted that these other studies were more selective with their inclusion criteria. Males accounted for two-thirds of the patients in this series.

The vast majority of recidivists presented only twice (94%) with smaller numbers presenting three or four times. These results suggest that multiple recidivism (greater than two presentations) is not a major problem.

In this study there were two age peaks of recidivists, young males and elderly females. This is in agreement with the findings of other studies that suggest young male adults are at higher risk of recidivism[2,4,5,6]. A second peak in incidence occurs in an older population where 28.7% of recidivists were over age 65 and 72.3% of these patients were female. This data is in accordance with another study that found trauma in the elderly was recurrent[3].
A fall was the most common repeated mechanism of injury, followed by road accidents and then interpersonal violence. The data was analysed in age-specific groups (figure 3). The vast majority (90.4%) of recidivists over 65 years of age presented with the same mechanism of injury and 98.7% of these were repeated falls. Younger recidivists were more likely to present with a different mechanism of injury second time round.

If appropriate education is aimed at high-risk groups, recidivism can be reduced[7]. The high proportion of patients representing with similar mechanisms of injury suggests that there may be a place for post-trauma education in certain high risk groups, like older women, to reduce the incidence of recidivism. This is especially true in patients where initial mechanism of injury is a fall or if the patient is female and over 65. This study supports the need for aggressive management of falls in the elderly.

Figure 1 Pattern of Trauma Recidivism (n=289)

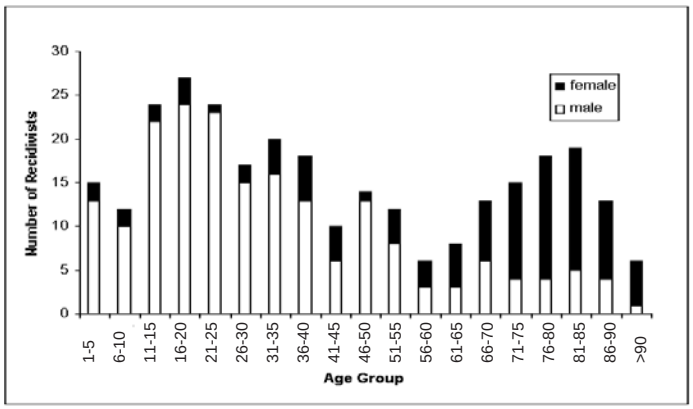


Figure 2 Patients with repeat mechanism of injury (n=151)

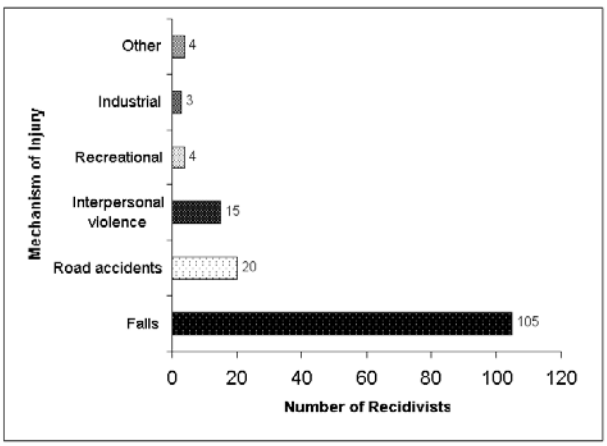
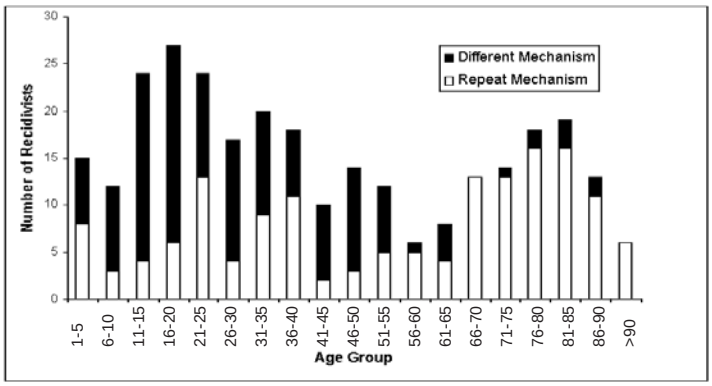


Figure 3 Mechanism of injury of Recidivism



REFERENCES

1. Tellez MG, Mackersie RC, Morabito D, Shagoury C, Heye C. Risks, costs and the expected complication of re-injury. Am J Surg 1995, Dec 170:6, 660-3
2. Kauffman CR, Branas CC, Brawley ML. A population-based study of trauma recidivism. J Trauma 1998 Aug 45:2, 325-31
3. Gubler KD, Majer RV, Davis R, Koepsell T, Soderberg R, Rivara FP. Trauma recidivism in the elderly. J Trauma 1996, Dec 41:6, 952-6
4. Cooper C, Eslinger D, Nash D, al-Zawahri J, Stolley P. Repeat vistims of violence: report of a large concurrent case-control study. Arch Surg 2000, Jul 135:7, 837-43
5. Buff TF, Abdu R. Repeat victims of violence in an urban trauma center. Violence Vict. 1995; Fall 10:3, 183-94
6. Redeker NS, Smeltzer SC, Kirkpatrick J, Parchment S. Risk factors of adolescent and young adult trauma victims. Am J Crit Care 1995, Sep 4:5, 370-8
7. Gentilello LM, Rivara FP, Donovan DM, Jurkovich GJ, Daranciang E, Dunn CW, Villaveces A, Compass M, Ries RR. Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. Ann Surg 1999, Oct 230:4, 473-80
8. Smith RS, Fry WR, Morabito DJ, Organ CH Jr. Recidivism in an urban trauma center. Arch Surg 1992, Jun 127:6, 668-70.

The External Fixator in Pelvic Fractures: Does it Control Haemorrhage?

William J Boswell (Final-year medical student. University of Manchester, UK), Martin Heetveld
Michael Sugrue Trauma Unit Liverpool

Introduction

The management of patients with pelvic fracture can be extremely challenging and this can be further compounded by the presence of pelvic haemorrhage. The overall mortality of patients with pelvic fractures is 8-16%.[1-5] Pelvic haemorrhage is the leading cause of death in up to 54% of patients with pelvic fractures.[6]

The source of bleeding in patients with pelvic fractures may be from either the venous plexus, arteries and/or bony surfaces. One postmortem angiography study[7] reported that 85% of cases showed extravasation of contrast from the hypogastric artery through the bone ends and damaged soft tissues. A report on a series of patients with pelvic fractures who had undergone arteriography[8] reported that 62% had a positive arteriogram (ie there was damage to one or more arteries, with extravasation of contrast). However autopsy findings in a further[9] report suggest that bleeding from the fracture site may be important as of ten patients who died from haemorrhage, 80% bled from the fracture site.

A number of methods have been advocated for controlling pelvic bleeding. External fixation of the pelvis is commonly used.

The aim of this review is to examine the evidence base supporting the use of external fixators to arrest or reduce haemorrhage in patients with pelvic fractures.

Methods and Materials

A literature search was performed using the Medline database, covering the years 1966 until October 2001 and the Embase database, covering the years 1980 until 2001. The keywords used were 'External Fixators' and 'Pelvic Bones' for the Medline database and 'External Fixators' and 'Pelvis' for the Embase database. This yielded 89 papers. Of these papers, those in a language other than English were excluded leaving 61 papers to be reviewed. Of these, those that clearly had no relevance to the use of external fixators in the management of pelvic fractures and those solely interested in paediatrics were excluded, leaving 45 papers.

The papers were then analysed further. Those that were letters to the editor, single case reports and general reviews were excluded

The websites of the orthopaedic trauma association[10] and trauma.org[11] contained reviews of the use of external fixators in the acute management of pelvic fractures. This yielded a further two papers, giving a total of 29 papers.

The papers remaining were grouped according to the guidelines of the National Health and Medical Research Council (NHMRC)[12].

Results

Authors:	Evidence Level:	Patients (n):	Comments:
Waikukul S et al, 1999[i]	II	112	Patients with unstable fractures (Tile's classification) randomized into group I (n=40) who received conventional management and group II (n=72) who received external fixation immediately. There was no significant difference between the groups in terms of pulse, BP, types of fracture and presence of other injuries. Group II had significantly less units of blood transfused (4.9 units, compared to 10.7 units, p=0.0001). There was no significant difference in terms of mortality.
Bassam D et al, 1998[ii]	III-2	15	Study looked at patients (haemodynamically unstable or ongoing haemorrhage) with pelvic fractures. They were divided into two groups. Group I (n=7) were those with mainly posterior fractures and had immediate angiography and embolization. Group II (n=8) were those with mainly anterior fractures and had immediate external fixation. Mortality was the same in both groups (1 patient in each) and the number of units of blood transfused similar (2 units in group I, 1.5 units in group II). However none of the patients in group I needed a secondary measure to control haemorrhage whereas 50% of those in group II needed angiographic embolization to control haemorrhage.
Evers BM 1989[4]	III-3	245	Looked at results of patients with pelvic fractures. Compared results of Pneumatic anti-shock garments (PASG) to immediate et al, external fixation. Patients having external fixation had significantly less blood transfused (8 units, compared to 23 units for the PASG group) but the authors commented that the fixator was used on more stable patients, making the results essentially meaningless.
Gylling SF et al, 1985[iii]	III-3	66	Patients with pelvic fractures involving major posterior elements and at least two breaks were deemed potentially unstable. These were then divided retrospectively into group I (n=26, clinically unstable pelvis) and group II (n=40, clinically stable pelvis). Group I had immediate external; fixation and group II were treated with bed rest. There was no significant difference in terms of mortality and blood transfused between the two groups.
Hupel TM et al, 1998[iv]	III-3	42	Patients with rotationally unstable pelvic fractures were divided into obese (n=10) and non-obese (n=32) categories. The study observed that although there was no significant difference in the injury severity score (ISS), obese patients were significantly more likely to have failure of their external fixator. No data were given on blood transfused or mortality rates.
Latenser BA 1991[v]	III-3	37	Patients were split into group I (n=18, pre-protocol for external fixation) and group II (n=19, post-protocol for external fixation). et al, The ISS was not significantly different between the two groups. Hospital stay and units of blood transfused were reduced, but not significantly so. Mortality was reduced significantly from 16.7% in group I to 0% in group II.
Riemer BL et al, 1993[vi]	III-3	605	Examined differences in mortality for patients with pelvic fractures in three time periods: 1981 (prior to inclusion of external fixation in the protocol for the management of pelvic injury), 1982 (transitional phase) and 1983-88 (protocol in use). Average ISS remained constant throughout the time periods analyzed. Mortality dropped significantly from 26% to 6% from 1981 to 1983-88. No data on blood transfusion were given.
Arazi M et al, 2000[vii]	IV	43	Patients with pelvic fractures (24 type B and 17 type C fractures). Two patients died, giving a mortality rate of 5%. The only The only statement on transfusion requirements was that 'Excessive blood transfusion was not required in any patient'. 'Excessive' was not defined and no data were given on transfusion.

Authors:	Evidence Level:	Patients (n):	Comments:
Broos P et al,1992[viii]	IV	44	All patients had 'complex' (Tile B or C) fractures. In 20 cases an external fixator was used. No data was given on the efficacy of this treatment modality as compared to the others used in this series.
Ebraheim NA et al, 1994[ix]	IV	19	All patients had tile type C posterior pelvic fractures. No data was given on the haemodynamic status of the patient prior to the procedure. Intra-procedural blood loss was estimate as less than 25cc. All fractures were described as healed.
Hammer RRR et al, 1996[x]	IV	8	Stage I involved the use of a simple external fixator in a peacetime setting for lower limb and pelvic fractures. The same fixator was used in a war setting in stage II. 6 pelvic fractures were treated in stage I, 2 in stage II. No good data was given on the acute management.
Lindahl J et al, 1999[xi]	IV	110	A review of patients treated with an external fixator. The external fixator was applied early (mean = 39 mins.). There was malunion in 58%. Mortality was 15%. No data were given on any other aspects of acute management.
Mears DC et al, 1980[xii]	IV	16	Analysis of patients with pelvic fractures. Mortality rate was 19% (ascribed to pulmonary complications). No data were given on any other aspects of acute management
Moreno C et al, 1986[6]	IV	538	Study looked at the 92 patients who required greater than 6 units of blood transfusing in the first 24 hours in hospital. Patients receiving external fixation (n=19) had a mortality rate of 5%. Overall mortality was 26% in the patients requiring more than 6 units of blood. However, the indications for the use of the various treatments used were not defined
Palmer S et al, 1997[xiii]	IV	24	Patients admitted under the care of one consultant admitted to the hospital with pelvic fractures treated with external fixation. 5 patients died within 48 hrs of admission (mortality rate 20.8%). All other patients survived. Complication rate of external fixation was 47%. No data was given on blood transfusion requirements. The data was from a specialist unit and a number of patients received initial management elsewhere before transfer (mean time to transfer was 9 days.)
Waikukal S et al, 1998[xiv]	IV	50	An account of the development of a new device for ensuring accurate pin placement when performing external fixation of pelvic fractures. Initial results from its use in 50 patients. No data were provided on blood loss or mortality.
Waikukal S et al, 1998[xv]	IV	36	Description of survey used to show that foot length equals inter anterior superior iliac spine distance. This phenomenon was used as a reference for placing external fixators in patients with unstable pelvic fractures. The only comment on these patients was that they had 'a good result'. External fixation was used as definitive treatment in 19 out of the 36 patients.
Williams RP et al, 1992[xvi]	IV	12	A cadvaer study on a new design of pelvic external fixator. The cadaveric pelvis's had a Malgaigne fracture inflicted. The study showed that the new design supported greater failure loads than standard equipment. The equipment was then used in 12 patients with a mixture of pelvic fracture types. No data was given on the situation in which the fixator was used or on transfusion requirements. All patients survived.
Garcia JM et al, 2000[xvii]	IV	N/A	A computer model of the pelvis was constructed and used to analyse external and internal fixations. Two variables were measured, diastase of pubis and vertical displacement. The study concluded that combined anterior and iliac external fixation worked in type B fractures but that external fixation didn't provide stability in type C fractures.
Ghanayem AJ et al, 1995[xviii]	IV	N/A	The study used CT scanning to assess how the pelvic volume changed in a fracture when external fixation, the pelvic stabiliser and a pelvic C-clamp were used. The study concluded that all three devices significantly reduced pelvic volume but that there was no significant difference between the three devices.
Ghanayem AJ et al, 1995[xix]	IV	N/A	The study used CT scanning to assess how pelvic volume changed in a cadaver with a pelvic fracture following laparotomy. The study concluded that the volume change was 15% in a non-stabilized injury, against 3% in a stabilized injury.
Grimm MR et al, 1998[xx]	IV	N/A	Water was pumped into the pelvis to simulate a patient haemorrhaging. The pressures and volumes of water were noted in an intact pelvis, a fractured pelvis and a fractured pelvis with an external fixator in place. The study concluded that external fixation may control venous haemorrhage by the tamponade effect (but only if large volumes of fluid are lost into the retroperitoneum first) and that external fixation has no effect in controlling arterial haemorrhage.
Kim et al, 1999[xxi]	IV	N/A	A Tile B1 fracture was inflicted on 5 cadavers and an external fixator applied. The study then looked at the amount of motion for different pin positions. It concluded that anteroinferior placement was superior to anterosuperior placement in terms of mediolateral displacement. Type C fractures were then simulated and the same experiment carried out, with the same results.
Moss et al, 1996[xxii]	IV	N/A	A model of the bony pelvis was constructed to allow the authors to measure the increase in pelvic volume that occurs with pelvic fractures. The study showed that for every 1cm that the pubic symphysis widened, there was a 4.6% increase in pelvic volume. For every 1 cm displacement at the sacroiliac joints there was a 3.1% increase in pelvic volume. The study concluded that the increase in pelvic volume in pelvic fractures was much less than previously thought.
Nordeen MH et al, 1993[xxiii]	IV	N/A	A cadaver study looking at placing external fixator pins between superior and inferior anterior iliac spines rather than on the superior iliac crest. Weight was added until the pin-bone interface failed. It was found that there was no significant difference between the two sites in terms of maximal weight-bearing. The data in this study are more related to stability of the fixation rather than haemorrhage control.
Rupp RE et al, 1994[xxiv]	IV	N/A	Cadaver study looking at the best site for pin placement with regard to minimising the complications for external fixation. No useful data regarding whether external fixation actually works in controlling haemorrhage and reducing mortality.
Simonian PT et al, 1995[xxv]	IV	N/A	The study looked at the amount of motion at the pubic rami and at the sacroiliac joints allowed by the Ganz clamp and anterior external fixation. The study concluded that the Ganz clamp allowed more anterior motion and the external fixator more posterior motion but that there was no overall difference in the amount of motion allowed between the two devices.
Vrahas et al, 1998[xxvi]	IV	N/A	Cadaver study looking at different techniques for external and internal fixation to find out which method provides the greatest degree of stability. Pelvic cadavers were filled with a non-distensible bag into which fluid could be added. 6 methods of fixation were tested, both internal and external. When the specimen was fixed, fluid was added and pressures recorded. Combined anteroposterior fixation was the most effective method. There were no significant differences between other types of fixation.

References: see page 15

Discussion

There is a paucity of prospective trials looking at the use of external fixators in the acute management of pelvic fractures. The majority of the data used is retrospective, with the inherent dangers of bias that is present in analyzing data collected in this manner.

Of the prospective studies, the paper by Waikukal et al 13 (level II evidence) gives evidence that suggests that early use of the external fixator is beneficial in reducing the need for blood transfusion but suggests that there is no difference in terms of mortality rates. The other prospective study by Bassam et al 14 (level III-2 evidence) is less promising in terms of recommending the use of external fixation. There was no significant difference in mortality rates or transfusion requirements between the angiography and external fixation groups.

The case series (level IV evidence) 6, give poor quality evidence regarding the use of external fixation. They are mostly a summary of results from a single institution and are not being compared to another group of patients receiving a treatment other than external fixation. This makes it difficult to draw many conclusions from them as the data can only be viewed in isolation.

The final group of papers are those that are cadaver or other non-clinical experiments. These suggest that external pelvic fixation may control any expansion in volume from pelvic fracture. However, they also suggest that external fixation is no better than any other technique, such as the Ganz clamp. Indeed, the paper by Grimm et al 32 suggests that although external fixation may control pelvic volume, it has no effect on controlling bleeding in the pelvis as the pressure it generates is not sufficient to produce a tamponade effect.

Most of the data found in this literature review is retrospective or in the form of experiments on cadavers. With only two prospective trials present in the literature it is hard to recommend the use of external fixators as a means to control haemorrhage from the data available. It is obvious however that some form of pelvic stabilization is required to avoid bony movement and achieve pain relief.

Editorial: The use of external fixator in haemorrhage control in haemodynamically unstable patients with pelvic fractures

Thomas Kossmann
Professor / Director Department of Trauma Surgery, The Alfred, Melbourne

Pelvic fractures in "polytrauma" patients are diagnosed in about 25% and in almost half of individuals of traffic-related fatalities. Therefore, a pelvic injury must be looked upon as an indicator of a major trauma and the proximity of osteoligamentous structures to pelvic organs, neurovascular, hollow-viscera and urogenital structures may lead to a wide range of severe complications if not diagnosed and treated immediately. The treatment protocol of unstable pelvic ring fractures differs between haemodynamically critical patients not suffering from extensive blood loss.

In haemodynamically unstable patients with pelvic ring instability, a standardised treatment protocol must be applied to guarantee the survival of the patient. The primary intervention(s) must concentrate on immediate control of the internal haemorrhage from the pelvic fracture and surrounding tissues. In most cases the origin of the bleeding is venous or from fracture surfaces and often a specific source cannot be identified. Control of such bleeding can be achieved by emergency external stabilization of the pelvic ring.

External fixation of the pelvic ring is a simple, rapid and effective method and can be done immediately in the emergency department. Devices used in these situations are the external fixator placed supra-acetabular and/or at the anterior iliac crest for anterior pelvic ring fractures and/or the C-clamp for posterior pelvic ring disruptions. In addition to control the retroperitoneal bleeding, it will minimise fracture site motion and avoid ongoing injury to the soft tissue.

If the patient remains hemodynamically unstable after application of these measurements (after approx. 10-15 minutes), immediate surgical haemostasis of the pelvic retroperitoneum must be achieved, considering temporary presacral and paravesical packing. However, this is only effective if the pelvic ring is sufficiently stable. Angiography and embolisation is recommended if substantial blood loss persists after applying the "gauze-tamponade". After 24-48 hours the tamponade is removed and in most cases ongoing packing is not required. The further treatment of the pelvic fracture is based upon the fracture type and additional injuries. In most cases, internal fixation of the pelvic fracture is recommended.

In the haemodynamically stable patient the full diagnostic work-up can be done, upon which the appropriate stabilization technique is applied at a convenient time.

References:

1. Poole GV and Ward EF. Causes of Mortality in Patients With Pelvic Fractures. Orthopedics. 1994; 17 (8): 691-6.

2. Dalal SA, Burgess AR, Siegel JH, Young JW, Brumback RJ, Poka A et al. Pelvic Fracture in Multiple Trauma: Classification by Mechanism is Key to Pattern of Organ Injury. Journal of Trauma. 1989; 29 (7): 981-1002.

3. Burgess AR, Eastridge BJ, Young JWR, Ellison TS, Ellison jr PS, Poka A et al. Pelvic Ring Disruptions: Effective Classification System and Treatment Protocols. The Journal of Trauma. 1990; 30 (7): 848-56.

4. Evers BM, Cryer HM and Miller FB. Pelvic Fracture Hemorrhage. Priorities in Management. Archives of Surgery. 1989; 124: 422-4.

5. Naam NH, Brown WH, Hurd R, Burdge RE and Kaminski DL. Major Pelvic Fractures. Archives of Surgery. 1983; 118: 610-6.

6. Moreno C, Moore EE, Rosenberger A and Cleveland HC. Hemorrhage Associated with Major Pelvic Fracture: A Multispeciality Challenge. Journal of Trauma. 1986; 26 (11): 987-94.

7. Huittinen VM and Slatis P. Postmortem angiography and dissection of the hypogastric artery in pelvic fractures. Surgery. 1973; 3: 452-462.

8. Kam J, Jackson H and Ben-Menachem Y. Vasular Injuries in Blunt pelvic Trauma. Radiologic Clinics of North America. 1981; 19 (1): 171-186.

9. Perry JF and McClellan RJ. Autosopy Findings in 127 Patients Following Fatal Traffic Accidents. Surgery, Gybecology and Obstetrics. 1964; :586-90.

10. http://www.hwbf.org/ota/s2k/abstracts/abstract.htm

11. http://www.trauma.org/ortho/exfix.html

12. National Health and Medical Research Council. A guide to the development, implementation and evaluation of clinical guidelines. November 1998.

13. Waikukal S, Harnroongroj T and Vanadurongwan V. Immediate Stabilization of Unstable Pelvic Fractures Versus Delayed Satbilization. Journal of the Medical Asociation of Thailand. 1999; 82 (7): 637-42.

14. Bassam D, Cephas GA, Ferguson KA, Beard LN and Young JS. A Protocol for the Initial Management of Unstable Pelvic Fractures. The American Surgeon. 1998; 64: 862-7.

15. Gylling SF, Ward RE, Holcroft JN, Bray JJ and Chapman MW. Immediate External Fixation of Unstable Pelvic Fractures. American Journal of Surgery. 1985; 150: 721-4.

16. Hupel TM, McKee MD, Waddell JP and Schemitsch EH. Primary External Fixation of Rotationally Unstable Pelvic Fractures in Obese Patients. Journal of Trauma: 1998; 45 (1): 111-5.

17. Latenser BA, Gentilello LM, Tarver AA, Thalgott JS and Batdorf JW. Improved Outcome with Early Fixation of Skeletally Unstable Pelvic Fractures. Journal of Trauma. 1991; 31 (1): 28-30.

18. Riemer BL, Butterfield SL, Diamond DL, Young JC, Raves JJ, Cottington E et al. Acute Mortality Associated With Injuries To The Pelvic Ring: The Role Of Early Patient Mobilization And External Fixation. Journal of Trauma. 1993; 35 (5): 671-7.

19. Arazi M, Kutlu A, Mutlu M, Yel M and Safa Kapiciglu MI. The pelvic external fixation: the mid-term results of 41 patients treated with a newly designed fixator. Archives of Orthopaedic and Trauma Surgery. 2000; 120: 584-6.

20. Broos P, Vanderschot P, Craninx L and Rommens P. TheOperative Treatment of Unstable Pelvic Ring Fractures. International Surgery. 1992; 77: 303-8.

21. Ebraheim NA, Coombs R, Jackson WT and Rusin JJ. Percutaneous Computed Tomography-Guided Stabilization of Posterior Pelvic Fractures. Clinical Orthopaedics and Related Research. 1994; 307: 222-8.

22. Hammer RRR, Rooser B, Lidman D and Smeds S. Simplified External Fixation for Primary Management of Severe Musculoskeletal Injuries Under War and Peace Time Conditions. Journal of Orthopaedic Trauma. 1996; 10 (8): 545-54.

23. Lindahl J, Hirvensalo E, Bostman O and Santavirta S. Failure of reduction with an external fixator in the management of injuries of the pelvic ring. Journal of bone and joint surgery (British edition). 1999; 81B: 955-62.

24. Mears DC and Fu F. External Fixation in Pelvic Fractures. Orthopaedic Clinics of North America. 1980; 11 (3): 465-79.

25. Palmer S, Fairbank AC and Bircher M. Surgical complications and implications of external fixation of pelvic fractures. Injury. 1997; 28 (9-10): 649-53.

26. Waikukal S, Kojaranon N, Vanadurongwan V and Harnroongroj T. An aiming device for pin fixation at the iliac crest for external fixation in unstable pelvic fracture. Injury. 1998; 29 (10): 757-62.

27. Waikukal S, Vanadurongwan V and Sakarnkosol S. Relationship between foot length and the inter anterior superior iliac distance. Injury. 1998; 29 (10): 763-7.

28. Williams RP, Friis EA, Cooke FW, McQueen DA and Toohey JS. External fixation of unstable Malgaigne fractures: the comparative mechanical performance of a new configuration. Orthopaedic Review. 1992; 21 (12): 1423-30.

29. Garcia JM, Doblare M, Seral F, Seral B, Palanca D and Gracia L. Three-dimensional Finite Element Analysis of Several Internal and External Pelvis Fixations. The Journal of Biomechanical Engineering. 2000; 122: 516-22.

30. Ghanayem AJ, Stover MD, Goldstein JA, Bellon E and Wilber JH. Emergent Treatment of Pelvic Fractures. Comparison of Methods for Stabilization. Clinical Orthopaedics and Related Research. 1995; 318: 75-80.

31. Ghanayem AJ, Wilber JH, Lieberman JM and Motta AO. The Effect of Laparotomy and External Fixator Stabilization on Pelvic Volume in an Unstable Pelvic Injury. Journal of Trauma: 1995; 38 (3): 396-401.

32. Grimm MR, Vrahas MS and Thomas KA. Prssure-Volume Characteristics of the Intact and Disrupted Pelvic Retroperitoneum. Journal of Trauma: 1998; 44 (3): 454-9.

33. Kim WK, Hearn TC, Seleem O, Mahalingham E, Stephen S and Tile M. Effect of Pin Location on Stability of Pelvic External Fixation. Clinical Orthopaedics and Related Research. 1999; 361: 237-44.

34. Moss MC and Bircher M. Volume changes within the ture pelvis during disruption of the pelvic ring: where does the haemorrhage go? Injury. 1996; 27 (S1): A21.

35. Noordeen MH, Taylor BA, Briggs TW and Lavy CB. Pin placement in external fixation. Injury. 1993; 24 (9): 581-4.

36. Rupp RE, Ebraheim NA and Jackson WT. Anatomic and Radiographic Considerations in the Placement of Anterior Pelvic External Fixator Pins. Clinical Orthopaedics and Related Research. 1994; 302: 213-8.

37. Simonian PT, Routt ML, Harrington RM and Tencer AF. Anterior Versus Posterior Fixation in the Unstable Pelvis. A Biomechanical Comparison. Clinical Orthopaedics and Related Research. 1995; 310: 245-51.

38. Vrahas MS, Wilson SC, Cummings PD and Paul EM. Comparison of fixation methods forpreventing pelvic ring expansion. Orthopedics (Thorofare, NJ). 1998; 21(3): 285-9.

An evaluation of a new direct information transfer system from pre-hospital to resuscitation room

Chris Bleakley, Ciara Brennan University of Belfast, Greg Hanson Ambulance Service NSW, Marj Salter Emergency Liverpool, Scott D'Amours, Michael Sugrue Trauma Liverpool.

INTRODUCTION

Trauma systems and guidelines improve outcomes of injured patients. Good communication with the trauma team is vital and it has been shown that the presence and implementation of a specialist trauma team improves patients' outcomes.[1] Direct and appropriate information transfer from pre-hospital caregivers to resuscitation room medical personnel is essential in improving care and reducing errors in trauma care.[2]

In early 2000, Liverpool Hospital introduced a direct radio link to ambulance officers in the field. The perception was that this improved communication. A study by Gerndt et al3 showed that use of a similar radio system was both cost effective and reduced delays in treatment. Delay in delivery of definitive care is associated with poorer outcomes.[4,5] To our knowledge there has been no published report into the adequacy of pre-hospital to resuscitation room information transfer in trauma patients.

The purpose of this audit was to evaluate the completeness of pre-hospital information provided to the trauma team using the hospital radio system. The hypothesis is that radio transmitted information is complete and worked well in our system.

METHODS

Liverpool Hospital is a 500 bed principal university teaching hospital and the designated Major Trauma Service for the South-Western Sydney Area Health Service, servicing a multi-cultural population of 750,000 people. It receives pre-arrival notification of impending trauma through the ambulance control via a dedicated telephone information transfer system.

A three week prospective audit of radio calls was undertaken of all patients transferred by the ambulance service to Liverpool Hospital who met the Ambulance Service of New South Wales (NSW) Protocol 4 criteria for transfer to a Major Trauma Service between November 8th and November 20th, 2000. Transfer of such patients requires pre-hospital communication between the ambulance officers and the hospital.

When a patient is seen by ambulance service personnel, their clinical condition is rapidly assessed by ambulance officers prior to hospital transfer. If the patient qualifies for bypass to a Major Trauma Service, the ambulance personnel radio the Emergency Department with pertinent information. An emergency department nurse or registrar answers the radio call; the radio used is set to use the New South Wales Government Radio Network (GRN) which is a radio communications network for government agencies covering the most populated areas of NSW.[6]

For the purpose of this audit, a standard tape recorder was secured near the radio in the Emergency Department resuscitation room and was used to record the radio operators' conversations. At the start of the conversation the radio operator activated the tape recorder and stopped it when the conversation had been completed. On answering the radio, the radio operator stated the sentence "this call will be recorded" and otherwise standard procedure was followed. Existing ambulance policy requires recording of all communication to the emergency department at ambulance service headquarters. At the end of each day recordings were reviewed and content was scored using a standard marking scheme (Figure 1).

Table 1 Table showing scores achieved for transfer of pre-hospital information

Criteria	Range of scores	Mean score (3 s.f.)	Mean score (/%) (3 s.f.)
Mechanism	1 - 2	1.8 / 3	60.0
Injury region	0 - 2	1.8 / 2	90.0
Signs	0 - 6	4.7 / 8	58.8
Treatment	1 - 3	2.3 / 4	57.5
Overall	0 - 3	2.0 / 3	66.7
Total	4 - 16	12.7 / 20	63.5

Information transfer utilised the "MIST" (mechanism, injury, signs and treatment) methods of information transfer.[7] An arbitrary scoring system was designed based on clinically perceived importance of each variable.

Data identifying the patient, ambulance officer or emergency department personnel was not recorded. The tapes were reviewed within 24 hours, erased and no copies were made. Responses given by Emergency Department staff to information provided by ambulance crews was not recorded. The ambulance crew were unaware of the specific data being collected for the audit from their conversation.

During the period of the audit, the number of patients arriving in the Emergency Department resuscitation room by ambulance without radio contact to the emergency department was also recorded. This was done to assess utilisation of the pre-hospital radio information transfer system.

RESULTS

During the 3-week audit period, 94 trauma patients were treated at Liverpool Hospital and 26 of these patients met criteria for bypass to a Major Trauma Service. Thirteen patients were excluded from the audit leaving 13 patients in the study. Seven because the operator failed to record the radio conversation; four because the ambulance controller relayed the information on behalf of the ambulance officers, thereby bypassing the radio system; two as they were transferred to Liverpool Hospital by Ambulance officers who did not have access to the radio system.

The scores achieved in each section of the marking scheme are shown in Table 1. No mention was ever made of whether the patient was trapped but otherwise mechanism of injury was complete in all cases. Injury region was omitted only once. With regard to clinical signs, the respiratory rate was not noted in a single case; GCS was omitted in four cases and pulse rate and blood pressure were only omitted twice. Under treatment, information on airway status was not transmitted; information on administration of drugs was omitted in six of the cases and fluids in five cases. In terms of the overall transfer of information, 9/13 cases had complete transfer of information in less than one minute; 8/13 cases had the information in the correct order. A further three had to repeat all or part of it, although once this was due to operator error in the resuscitation room and twice it was because of radio interference.

Figure 1

AMBULANCE INFORMATION FOR TRAUMA EMERGENCIES

Categories	Potential Score	Actual
MECHANISM		
Age and Sex	1	
Cause of Injury	1	
Trapped	1	
INJURY REGION	2	
SIGNS		
Pulse	2	
Blood Pressure	2	
Respiratory Rate	2	
GCS	2	
TREATMENT		
Intubated	1	
Fluids	1	
Drugs	1	
ETA to Hospital	1	
OVERALL		
Time < 1 minute	1	
Correct Order	1	
No Repetition	1	
TOTAL SCORE	20	
Comment		
Date	Time	

DISCUSSION

This study is one of the first of its type to assess and report accuracy of pre-hospital to resuscitation information. The study identified accurate transfer of information. While there is certainly an opportunity to improve on information transfer particularly in relation to completeness of the patients vitals signs, and treatment given prehospital this study supports the wider use of the radio to resuscitation room communication.

REFERENCES

1. McDermott FT, Cordner SM, Tremayne AB. Reproducibility of preventable death judgments and problem identification in 60 consecutive road trauma fatalities in Victoria, Australia. Consultative Committee on Road Traffic Fatalities in Victoria. J Trauma 1997;43(5): 831-9.

2. Petrie D, Lane P, Stewart TC. An evaluation of patient outcomes comparing trauma team activation versus trauma team not activated using TRISS analysis. J Trauma 1996;41:870-875.

3. Gerndt SJ, Conley JL, Lowell MJ, et al. Pre-hospital classification combined with an in-hospital trauma radio system response reduces cost and duration of evaluation of the injured patient. Surgery 1995;118(4):789-94

4. Barrett B, Guly HR. On scene time in incidents responded to by urban and rural ambulances. Pre-hospital Immediate Care 1999;3:145-148

5. Sampalis JS, Denis R, Fréchette P, et al. Direct transport to tertiary trauma centers versus transfer from lower level facilities: impact on mortality and morbidity among patients with major trauma. J Trauma 1997;43(2):288-95

6. Government Radio Network NSW. http://www.telstra.com.au/e-state/wireless/nsw.cfm

7. D'Amours SK Sugrue M Deane S Initial Management of the Poly-Trauma Patient: A Practical Approach in an Australian Major Trauma Service Scan J Sugr 2002;91:23-22

Case History Reviewed

52 year old train passenger

M - Hit by train from behind

I - Large laceration extending from left lower flank to left buttock
Pain in lower back and left arm
Large blood loss observed at the scene

S - P 80bpm. BP 100 systolic. GCS 15

T - Hard collar, MAST suit, 20mg morphine and 11 Gelofusin

Primary Survey

A - Patient maintained. Hard collar in situ

B - Breathing spontaneously. AE L=R. Chest clear

C - P 66bpm. BP 114/73

D - GCS 15. PERL.

Secondary Survey

- Pelvic / left iliac fossa tenderness. No blood at urethral meatus.
- Deep laceration of perineum and left buttock extending antero-cranially.
- Reduced anal tone.
- Left leg 3cm shorter than right but neurovascularly intact.

The patient was subsequently transferred to Liverpool Hospital. The MAST suit had been removed and a sheet tied around his pelvis

Subsequently

He went to laparotomy where he had a defunctioning colostomy and rectal washout. His perineum was debrided and his pelvis was fixed initially externally and then internally. He made a slow recovery after 2 month and 2 perianal reconstructions was discharged. He will be having his colostomy closed in 3 months.

Meetings

Definitive Surgical Trauma Care Course (DSTC)

Liverpool: 31st July and 1st August, 2002
Contact: Michael Sugrue or Charmaine Miranda
(61 2) 9828 3928
Email: charmaine.miranda@swsahs.nsw.gov.au

Melbourne: 11th & 12th November, 2002
Contact: Peter Danne or Judy Forsyth
(61 3) 9342 7232
Email: Judy.Forsyth@mh.org.au

SWAN 10

SWAN 10 will be held on the 2nd and 3rd of August, 2002, bringing to you a number of world leaders in trauma care from overseas. Registration is limited, so get in early!

Contact: Thelma Allen
Email thelma.allen@swsahs.nsw.gov.au
Phone: (61 2) 9828 3927
http://www.swsahs.nsw.gov.au/livtrauma
Remember if you are not a member of Australian Trauma Society - you could be!

References:

1. Waikukal S, Harnroongroj T and Vanadurongwan V. Immediate Stabilization of Unstable Pelvic Fractures Versus Delayed Satbilization. Journal of the Medical Asociation of Thailand. 1999; 82 (7): 637-42.

2. Bassam D, Cephas GA, Ferguson KA, Beard LN and Young JS. A Protocol for the Initial Management of Unstable Pelvic Fractures. American Surgeon. 1998; 64: 862-7.

3. Gylling SF, Ward RE, Holcroft JN, Bray JJ and Chapman MW. Immediate External Fixation of Unstable Pelvic Fractures. American Journal of Surgery. 1985; 150: 721-4.

4. Hupel TM, McKee MD, Waddell JP and Schemitsch EH. Primary External Fixation of Rotationally Unstable Pelvic Fractures in Obese Patients. The Journal of Trauma: Injury, Infection and Critical Care. 1998; 45 (1): 111-5.

5. Latenser BA, Gentilello LM, Tarver AA, Thalgott JS and Batdorf JW. Improved Outcome with Early Fixation of Skeletally Unstable Pelvic Fractures. Journal of Trauma. 1991; 31 (1): 28-30.

6. Riemer BL, Butterfield SL, Diamond DL, Young JC, Raves JJ, Cottington E et al. Acute Mortality Associated With Injuries To The Pelvic Ring: The Role Of Early Patient Mobilization And External Fixation. Journal of Trauma. 1993; 35 (5): 671-7.

7. Arazi M, Kutlu A, Mutlu M, Yel M and Safa Kapiciglu MI. The pelvic external fixation: the mid-term results of 41 patients treated with a newly designed fixator. Archives of Orthopaedic and Trauma Surgery. 2000; 120: 584-6.

8. Broos P, Vanderschot P, Craninx L and Rommens P. TheOperative Treatment of Unstable Pelvic Ring Fractures. International Surgery. 1992; 77: 303-8.

9. Ebraheim NA, Coombs R, Jackson WT and Rusin JJ. Percutaneous Computed Tomography-Guided Stabilization of Posterior Pelvic Fractures. Clinical Orthopaedics and Related Research. 1994; 307: 222-8.

10. Hammer RRR, Rooser B, Lidman D and Smeds S. Simplified External Fixation for Primary Management of Severe Musculoskeletal Injuries Under War and Peace Time Conditions. Journal of Orthopaedic Trauma. 1996; 10 (8): 545-54.

11. Lindahl J, Hirvensalo E, Bostman O and Santavirta S. Failure of reduction with an external fixator in the management of injuries of the pelvic ring. Journal of bone and joint surgery (British edition). 1999; 81B: 955-62.

12. Mears DC and Fu F. External Fixation in Pelvic Fractures. Orthopaedic Clinics of North America. 1980; 11 (3): 465-79.

13. Palmer S, Fairbank AC and Bircher M. Surgical complications and implications of external fixation of pelvic fractures. Injury. 1997; 28 (9-10): 649-53.

14. Waikukal S, Kojaranon N, Vanadurongwan V and Harnroongroj T. An aiming device for pin fixation at the iliac crest for external fixation in unstable pelvic fracture. Injury. 1998; 29 (10): 757-62.

15. Waikukal S, Vanadurongwan V and Sakarnkosol S. Relationship between foot length and the inter anterior superior iliac distance. Injury. 1998; 29 (10): 763-7.

16. Williams RP, Friis EA, Cooke FW, McQueen DA and Toohey JS. External fixation of unstable Malgaigne fractures: the comparative mechanical performance of a new configuration. Orthopaedic Review. 1992; 21 (12): 1423-30.

17. Garcia JM, Doblare M, Seral F, Seral B, Palanca D and Gracia L. Three-dimensional Finite Element Analysis of Several Internal and External Pelvis Fixations. Journal of Biomechanical Engineering. 2000; 122: 516-22.

18. Ghanayem AJ, Stover MD, Goldstein JA, Bellon E and Wilber JH. Emergent Treatment of Pelvic Fractures. Comparison of Methods for Stabilization. Clinical Orthopaedics and Related Research. 1995; 318: 75-80.

19. Ghanayem AJ, Wilber JH, Lieberman JM and Motta AO. The Effect of Laparotomy and External Fixator Stabilization on Pelvic Volume in an Unstable Pelvic Injury. Journal of Trauma: 1995; 38 (3): 396-401.

20. Grimm MR, Vrahas MS and Thomas KA. Prssure-Volume Characteristics of the Intact and Disrupted Pelvic Retroperitoneum. Journal of Trauma: 1998; 44 (3): 454-9.

21. Kim WK, Hearn TC, Seleem O, Mahalingham E, Stephen S and Tile M. Effect of Pin Location on Stability of Pelvic External Fixation. Clinical Orthopaedics and Related Research. 1999; 361: 237-44.

22. Moss MC and Bircher M. Volume changes within the ture pelvis during disruption of the pelvic ring: where does the haemorrhage go? Injury. 1996; 27 (S1): A21.

23. Noordeen MH, Taylor BA, Briggs TW and Lavy CB. Pin placement in external fixation. Injury. 1993; 24 (9): 581-4.

24. Rupp RE, Ebraheim NA and Jackson WT. Anatomic and Radiographic Considerations in the Placement of Anterior Pelvic External Fixator Pins. Clinical Orthopaedics and Related Research. 1994; 302: 213-8.

25. Simonian PT, Routt ML, Harrington RM and Tencer AF. Anterior Versus Posterior Fixation in the Unstable Pelvis. A Biomechanical Comparison. Clinical Orthopaedics and Related Research. 1995; 310: 245-51.

26. Vrahas MS, Wilson SC, Cummings PD and Paul EM. Comparison of fixation methods forpreventing pelvic ring expansion. Orthopedics (Thorofare, NJ). 1998; 21(3): 285-9.

©1996 Trauma Department Liverpool Letters to Dr Michael Sugrue
Trauma Department, Liverpool Hospital,
Elizabeth Street NSW 2170 Fax 9828 3922
www.swsahs.nsw.gov/livtrauma Email:michael.sugrue@swsahs.nsw.gov.au

The Trauma Grapevine is owned, published, copyrighted © 2001 It is sponsored by B Braun. All rights reserved.
Editorial Offices: Trauma Department Liverpool Hospital Locked bag 7103 Liverpool BC 1871 Australia
Phone: (61) 2 98283927 Fax: (61) 2 98283926