18

Technologies, Therapies, Emotions and Empericism in Pre-hospital Care

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INTRODUCTION

Trauma patients form a heterogeneous group who have suffered tissue damage from exposure to some form of energy. The most common denominator in any trauma patient is bleeding. This could be external or internal bleeding. Neuronal damage and direct damage to chest, abdominal viscera all significantly modify the outcome of trauma, independently and along with physiological changes associated with bleeding. Over 50 per cent of trauma patient's mortality in the first hour results from traumatic brain injury. Traditionally accepted markers of physiological status of the patient are used for monitoring the patient's condition in most situations. These include pulse, blood pressure, respiratory rate and temperature and in a head injury patient the level of consciousness of the patient. However, monitoring parameters in the field situation and taking steps to correct them are difficult because changes in physiological parameters in the body are closely linked to multiple organ systems. No system can be taken in isolation.

Pre-hospital care developed as a speciality to minimize the damage to the patient before definitive care is made available. A lot of controversy exists regarding what should be the ideal pre-hospital management for the injured patient. No system is ideal for all areas. Policy formulations for pre-hospital management of the injured will obviously be determined by the availability of trained personnel and technological and economic resources at hand. But what is the optimum level of care and who should provide it? In other words, what pre-hospital interventions should we make when we have all the resources to ensure that the largest number of trauma patients survive with minimum morbidity.

BEYOND THE ABC OF RESUSCITATION?

Conventional first-aid to an injured includes resuscitation, dressing of wounds and splintage. In principle resuscitation at the accident site and at the hospital site is not very much different. The classical description of the ABC of resuscitation took care of the most vital aspects of survival for a patient and also prioritized the sequence of intervention, that is the maintenance of a clear Airway, establishment of Breathing, and establishment and assessment of Circulation. To achieve these a large number of technologies and therapies have developed over the years.

Different centres for pre-hospital care follow different protocols. These include: Basic Life Support (BLS), Pre-hosPital Trauma Life Support (PHTLS) and Advanced

Trauma Life Support (ATLS). Several recent reports are available on the relevance of individual components of these protocols and experimental studies to validate them (Sampalis, 1992; 1994; Martin, 1992; Bickel, 1994; Teach, 1995; Adams, 1996; Eisen, 1998; Bissell, 1998). Pre-hospital resuscitation theoretically results in improved end organ perfusion and oxygen delivery in the pre-operative phase, in the field and during patient transfer reducing subsequent morbidity and mortality (Owens, 1995). A review of the ABC of resuscitation steps should clarify some of the controversies surrounding pre-hospital care.

Maintenance of a clear airway

Extension of neck and elevation of chin may be the only step required for maintenance of a clear airway. At times this may not be sufficient. Foreign bodies, blood and vomitus in the mouth may need to be cleared. The oesophageal obturator airway is designed to provide ventilation by occluding the oesophagus and by default forcing oxygen through the oropharynx into the trachea and lungs (Don Michael, 1968). This is not routinely recommended now because of several complications associated with it.. According to the ATLS protocol (ATLS 1993), if the patient is not breathing after clearing of airway then insertion of an endotracheal tube may be required. However, endotracheal intubation is a procedure, which needs training and skill. This will need a medical or paramedical person to be present at the accident site. Some countries have restrictions on the use of endotracheal tubes and only licensed persons are allowed to insert them. A lay person cannot do endotracheal intubation. At times endotracheal intubation can be done only with narcotic analgesics (Gerich, 1998), midazolam (Dickinson, 1999) for 'clenched teeth' may prevent attempts at intubation. A small percentage of these endotracheal tubes may actually be in the oesophagus (Pointer, 1988; Gerich, 1998; Dickinson, 1999). However, Gerich (1998) reports that only 1 out of the 8 patients with surgical airways survived. Combitube is another alternative for airway management in emergency situations where personnel trained in tracheal intubation are not available.

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According to some of the protocols, repeated failed attempts and inability to maintain sufficient oxygen saturation (90 per cent), during repeated intubation attempts represent indications for surgical air way by doing a cricothyrotomy (Gerich, 1998).

Irreversible brain damage occurs between 5–10 minutes of cessation of breathing. To provide a trained person at the accident scene within this period is very difficult. Help from bystanders can be useful during this time. A trained bystander could call for help, clear the airway or extend the neck, lift the chin to ensure breathing.

If after clearing of the airway the patient does not breathe he will need mouth-to-mouth-expired-air-ventilation or if available a bag-valve-mask-ventilation. Mouth-to-mouth-expired-air-ventilation is a highly specialized psychomotor skill, which has to be learnt, rehearsed regularly before it can be performed successfully. In a Norwegian study (Bjorshol, 1996), among health and rescue workers outside hospital it was found that only 1 per cent were able to perform satisfactory cardiopulmonary resuscitation (CPR) of cardiac arrest patients according to accepted guidelines. Of these only 17 per cent ventilated and compressed efficiently with a rhythm of 2 breaths for 15 external cardiac compressions or 1 breath for 5 cardiac compressions, and 50 per cent believed that they were efficient in life saving first aid.

There is a wide variation in the effectiveness of mouth-to-mouth resuscitation provided for cardiopulmonary arrest. The best results are obtained only when the person providing CPR is periodically rehearsing the procedure.

In a patient with a high probability of cervical spine injury manipulating the neck for endotracheal intubation could be dangerous. More sophisticated techniques of nasotracheal or fibreoptic assisted intubation technique are recommended for these patients. New technologies going well beyond the simple ABC of resuscitation!

Establishment / assessment of circulation

Most trauma patients bleed. Bleeding could either manifest externally or could be occult, internally. Internal bleeding is particularly difficult to assess if it is occurring in the abdominal or pelvic cavity. Bleeding into the chest is also difficult to assess but the dramatic presentation of an associated lung or heart injury may give sufficient warning of the damage underneath. If the patient's assessment is done soon after the injury and pulse and blood pressure parameters are taken as gold standards, then there could be a serious error of judgement as haemorrhage into closed cavities may take time to manifest as alterations in these measured values. This is because it takes sometime before physiological signs of compensation or decompensation become apparent.

The human circulatory system functions as a closed loop. Any break in the vessels converts this closed loop into an open system. As more and more blood leaks out, the heart will have less and less blood available to pump. Initially the body compensates by increasing the heart rate and then mobilizing fluids away from the non-vital parts of the body. With decreasing blood in the system the blood pressure drops pulse becomes rapid and feeble till it cannot be felt. Medically such a patient is described to be in a state of haemorrhagic shock. There are numerous definitions of haemorraghic shock involving blood pressure, heart rate and urine output. Traditionally, when blood pressure, heart rate and urine output return to normal it was presumed that resuscitation was complete. However, a majority of patients may not be in uncompensated shock and some patients of compensated shock may continue to have clinical signs of uncompensated shock (Porter, 1998).

Pre-hospital medical care and care in the hospital is aimed at preventing the development of traumatic haemorrhagic shock and the consequences of shock in an injured patient. This can be achieved by

- control of bleeding
- replacing the blood lost with blood
- replacing the blood volume lost by fluid replacement.

Control of bleeding

If the patient is bleeding externally, direct pressure with a gauze or a clean cloth is an effective method of controlling blood loss. If the wound is on the limbs then elevation and direct pressure together are very effective.

Tourniquets, which were once popular as effective method of controlling blood loss, are now not recommended at all. In fact, tourniquets are dangerous and some patients have even lost their limbs because of improper use of tourniquets. Direct pressure and elevation are the only safe methods recommended.

Internal bleeding cannot usually be controlled by non-surgical methods. Assessment of blood loss internally into the chest or abdomen is very difficult in the pre-hospital phase. Hence in patients with suspected chest or abdominal injuries the aim should be to transfer the patient as quickly as possible to a hospital for definitive treatment.

Blood transfusion

Replacing blood for blood is ideal intervention theoretically. This is neither possible nor desirable in all injured patients receiving pre-hospital care. This is not possible in all patients or desirable in injury patients receiving pre hospital care. O(-ve) is a rare blood group and its availability is poor even in hospitals. With the possibility of HIV and hepatitis infection there is an added deterrent to the use of blood widely in trauma patients. There are some ambulances in the world which have blood banks with O(-ve) blood. If direct cross matching is to be done this takes about 30 minutes. There does not seem to be any additional advantage in having blood available within ambulances.

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Blood group identification is recommended by some transport authorities to be included in the driving license. Though it is good to know your blood group for donating others, advance knowledge of blood group of the injured patients does not in any way hasten the transfusion of blood. This is because blood matching has to be done by the care provider in any case.

Intravenous fluids

Intravenous fluids are widely used as volume replacements for blood loss. This is done both in the pre-hospital and in the hospital phase. Placement of intravenous access lines is considered an important part of pre-hospital care. The ATLS protocol specifically recommends the insertion of two large bore (16 G or more) catheters for intravenous fluid transfusion. In adult injured patients 1-2 litres of Ringer's lactates are recommended.

Krausz (1992) found that intravenous access placement failed in 27 per cent of cases and an average of 10–12 minutes were lost in placement of intravenous cannula. Placement of an intravenous cannula is particularly difficult in a shocked patient as all the veins

collapse in shock. In children this is difficult even when they are not in shock as the normal caliber of their veins is small.

A number of studies recommend starting of intravenous line on the plea that it can maintain the fluid volume in circulation when it is compromised as a result of injury. Lewis (1986) has shown that intravenous infusion is of benefit only if the bleeding rate is more than 25–100ml per minute, the pre-hospital time is more than 30 minutes and the intravenous infusion rate is equal to the bleeding rate.

Newer technologies being made available aim at increasing the volume of fluid infused in shorter times to keep pace with the rate of loss of blood. These include very large bore catheters and use of rapid infusion devices. In children intraosseus infusion has been recommended to overcome the difficulties of intravenous cannula placement. This has been associated with complications of osteomyelitis and compartment syndromes.

Hypertonic saline has been used on the rationale that only smaller volumes need to be transfused, and that they help mobilize body fluids faster. All these techniques are aimed at increasing the circulating fluid volume in the presence of a leaking closed loop of the system.

Recent animal experiments have shown that in swine models aggressive saline infusion led to greater bleeding and failed to improve survival (Kowalenoko, 1992; Owens, 1995). In rat tail experiments using hypertonic saline Krausz (1992) reported greater bleeding and rapid haemodynamic worsening and early death when infusion were given without control of bleeding. Results of experiments in mice show that haemodilution is an unfavourable condition for the natural defense mechanism against hemorrhage (Okumura, 1995).

A critical review of earlier experiments showing that intravenous fluids were useful clearly reveals a design flaw in the experiments. In all these experiments a certain percentage of blood volume of the experimental animal was withdrawn and then the effect of fluid replacement studied. In the newer experimental design blood was withdrawn and a cannula was left in the place (or by some other method) to simulate continuous bleeding. This change in technique produced dramatically different results.

In normal human physiology continued bleeding leads to a reduction in blood pressure. This reduction in blood pressure causes the initiation of a reflex narrowing of blood vessels carrying blood to the periphery. The lowering of blood pressure and narrowing of blood vessels reduce the pressure head of blood at the injured site. This allows clot formation and sealing off all injured vessels.

By infusing intravenous fluids without controlling bleeding the normal physiological response of the body is prevented. This delays clot formation and sealing of injured blood vessels. The blood loss therefore, can be much more than when no infusions are given. The reason for not seeing a marked increase in mortality and haemorrhage in the patients infused with intravenous fluids is possibly because of the fact that the rate and volume of fluid infused in most pre-hospital injured patients is very low.

The volume as well as the rate of fluid infusion seems to influence the outcome of haemorrhage in experimental studies. Rapid infusions of large volumes increased blood loss but seemed to improve survival. Where as moderate fluid volume was not associated with significant blood loss regardless of rate. The greatest blood loss was seen in animals with slower rates of infusion (Soucy, 1999). The correct rate of infusion and volume of infusion in any given patient is still a matter of conjecture though a number of algorithms are available.

In an evaluation of the use of intravenous fluids in penetrating truncal injury patients (Martin, 1992) found no significant difference in post-operative

complications and rate of survival to hospital discharge. The study concluded that further studies are necessary to determine if it is advantageous to delay fluid resuscitation until surgical intervention. In pre-hospital times of 30–40 minutes, mortality following trauma is not influenced by the pre-hospital administration of intravenous fluids but is related to the severity of underlying injuries (Kaweski, 1990). Bickell (1994) found improved survival and decreased perioperative complications in patients with penetrating torso injuries with delayed resuscitation. Teach (1995) found pre-hospital fluid therapy was inconsequential to outcome in 47 of 50 patients, possibly beneficial in 2 out of 50 and possibly detrimental in one of 50 patients.

Though widely used all over the world, increasing evidence suggests that infusion of intravenous fluids in the pre-hospital setting, may not be useful but could be harmful also.

Pneumatic antishock garments (PASG) or military antishock trousers (MAST)

These were introduced in 1970 for use in trauma patients. PASG corrects hypotension of increasing peripheral resistance and by autotransfusion of blood from the compressed site to the central area of circulation. Serious complications have been associated with its use. They involve development of neurovascular injuries, development of compartment syndromes and pressure necrosis. In a healthy volunteers study, PASG was found to reduce the vital capacity and tidal volume of volunteers significantly. MAST markedly decreased the abdominal contribution of breathing (-57 per cent ± 22per cent) (Riou, 1991). Survival of injured patients is not improved despite increase in blood pressure. In a prospective randomized study no significant differences were found in hospital stay and mortaility following use of PASG (Chang, 1995). The use of PASG or MAST is not recommended any more in the pre-hospital setting.

In summary ,the best treatment for bleeding in a traumatized patient is surgical control of bleeding and not haemodynamic manipulations with fluids, blood or PASG.

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Pre-hospital cardiac arrest

If bleeding continues and the volume of blood reduces markedly, the heart will stop functioning as a result of hypoxia and decreased volume of blood to pump. The heart could also arrest as a result of direct injury to the heart and lungs or as a result of head injury causing damage to vital centres.

In trauma 60 per cent of deaths occurs at the site of injury and 40 per cent occur in the hospital (Kries Jr., 1986). In Trunkey's classification 50 per cent of deaths in trauma occur immediately within 1st hour, 30 per cent occur early (1 hr–1 week) while 20 per cent deaths occur late (after 1 week) (Trunkey, 1983). The immediate and late trauma death rates are not affected by changes in pre-hospital care. Some of the early deaths can possibly be prevented by interventions in the pre-hospital period. The 'golden hour' as described by Cowley (1977) and the 'platinum half hour' as described by Pepe (1990) underlines the importance of early interventions in trauma patients. However, if a trauma patient develops a cardiac arrest before he reaches the hospital the chances of survival are poor even after cardiopulmonary resuscitation. In a study of 138 cases who had CPR in the pre-hospital period there were no survivors (Rosemurgy, 1993). In 23 patients who required CPR in the pre-hospital phase again there were no survivors (Tsai, 1987). Gallagher (1955) found that only 46 per cent of bystanders were able to do effective CPR in outside hospital cardiac arrest.

Increasing number of studies are reporting the futility of attempting CPR in the pre-hospital cardiac arrest patients in trauma.

Triage

The classification of patients according to medical needs and matching of these patients to available care resources is called triage. This helps to save time and avoids shunting of patients from one centre to another. For optimal allocation of resources in the treatment of trauma it would be useful to be able to decide as early as possible which patient will benefit most from transport to a dedicated trauma centre (Bond, 1997). This may be difficult in patients who have neuronal injury or truncal injury which is in the early evolving phase. Different criteria and indices have been evolved for transportation of patients to a designated trauma centre. The pre-hospital index takes into consideration, systolic blood pressure, pulse/min, respiration and consciousness. An index of 0 to 3 is minor trauma, 4 to 20 is major trauma. This is reportedly better when the mechanism of injury criteria is also taken into consideration (extrication time is more than 20 minutes, ejection, occupant death, steering wheel deformity, fall of more than 50 feet and injuries of automobile vs pedestrians). The ideal triage criteria in any given situation is difficult.

Ambulances and transportation of patients

Ambulances have become synonymous with transportation of the injured and the sick. Transportation of the injured have been done in all kinds of vehicles. Faster and more comfortable modes of transportation have been designed with a view to take the patient as rapidly as possible to a definitive care facility.

The time interval between injury and arrival at a hospital has an influence on the outcome of trauma. A comparison of transportation time of patients in different wars of this century is summarized in Table 1.

Table 1
Summary of mortality rates and transportation times in different wars of this century

WAR	TRANSPORTATION TIME (in hours)	MORTALITY
World War I	12–16	8 %
World War II	6–12	4.5%
Korean War	2–4	2.5%
Vietnam War	1.5–2	2 %

The marked decrease in mortality in the Vietnam war cannot be attributed to a reduction in pre-hospital times alone. Hospital care of injured has changed completely between World War I and the Vietnam war. Reduction in transportation time is only one of the parameters that had changed between World War I and the Vietnam War.

When a person is injured it is assumed that he or she will be transported by an ambulance to the hospital. In reality, in a large number of countries this is not so. This is particularly true in a number of rural areas of the world and urban areas of several low income countries. Even in high income countries some of the patients are transported by non-EMS vehicles (Demetriades, 1996). Interestingly patients with severe trauma transported by private means in this setting were found to have better survival than those transported via EMS system. Persons without access to telephone also often use private transport to transfer trauma patients to a trauma centre. Of the 4 per cent patients transported in private vehicles 50 per cent did not have access to telephone. Among the others, fear of delay and under estimation of the severity of trauma were the other causes (Hammond, 1993). In Philadelphia 61 per cent of Police Chiefs indicated that police officers would occasionally 'scoop and run' with a critically ill child rather than wait for the emergency medical services to arrive (Sinclair, 1991).

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In a study done in Delhi it was found that ambulances transported only 4 per cent of patients. Of the injured 51 per cent were transported to the hospital by taxies. About 53 per cent of these patients were transported within 30 minutes of the injury (Maheshwari, 1989). Despite the fact that they were not transported in ambulances this is comparable to some of the best transportation times in the world with good communication facilities and excellent ambulance services. In a comparative study of trauma mortality patterns, Mock (1998) reported no patients were transported in ambulances to a teaching hospital in Ghana while over 90 per cent were transported by ambulances in Mexico and Seattle. In Ghana 58 per cent were transported by ambulances and 22 per cent by private cars. The differences in mortality in this study could not truly be attributed to increased time of transportation or differences in treatment.

Equipment in ambulances

The ambulance itself may be a simple vehicle with a stretcher or it could be fitted with the most sophisticated equipment for monitoring and providing advanced cardiac life support with

defibrillators. In trauma patients the probability of revival after pre-hospital cardiac arrest is practically nil, unlike in cardiac disease patients. Usually the injury has caused so much of haemorrhage that the oxygen carrying capacity of blood would be significantly deranged and the myocardium is unlikely to respond to defibrillation.

Numerous other equipment like suction machines and immobilization devices for limb or spinal trauma also form part of ambulance equipment. However, there is no data to suggest that use of these equipment alter the outcome of trauma.

Speed of ambulances

Though it is important for the injured patient to reach a definitive care facility at the earliest in urban situations with short transportation times excessive speeding cannot improve transportation times. This speeding may in fact contribute to risk of injury to patients, other motorists and pedestrian on the road. The incidence of fatal ambulance crashes during emergency use is reportedly higher than during non-emergency use. These are particularly higher for lights and siren travel (Saunders, 1994; Pirrallo, 1994). There are anecdotal reports of injuries to patients and people outside ambulances involved in crashes.

A recent study has shown that ambulances with flashing lights and sirens do not significantly reduce patient transportation time. The study used ambulances with lights and sirens and a control ambulance without any of these, it revealed the mean time saved to be 43.5 seconds in 50 trips (Hunt, 1995). Use of sirens also significantly disturbs the patients being carried in it. The noise of sirens and traffic also disturb recording of blood pressures of patients in moving ambulances (Prasad, 1994).

Air ambulances

Air ambulances have been promoted with a view to reduce transportation times and hence reduce mortality. air ambulances are costly, and their health benefits are small (Snooks, 1996). The study found that there was no improvement in response times and the time on scene was longer for helicopter-attended patients. Logistic regression analysis in helicopter transported trauma patients have shown that transportation by helicopter does not affect the estimated odds of survival (Brathwaite, 1998).

Another study showed that a large majority of trauma patients transported by both helicopter and ground ambulance has low injury severity measures. Outcomes were not uniformly better among patients transported by helicopter. Only a very small subset of patients transported by helicopter appear to have any chance of improved survival based on their helicopter transport (Cunningham, 1997). Doubtful benefits have also been reported by Koury (1998) and increased mortality, 18 per cent compared to 13 per cent for ground transported patients for helicopter transportation of victims in urban area Schiller (1988)..

Helicopter services may have a role in remote inaccessible areas in the sea, desert or mountains. However, routine use of air ambulances in the urban setting is not cost effective.

Ambulance personnel

The number and training of ambulance personnel varies from place to place. Some have only drivers trained in emergency care while others have emergency care paramedics. In some parts of the world there are physician-manned ambulances. Trained medics and paramedics are posted in the emergency medical service ambulance to

ensure that the trauma patients receive optimal care from the site of injury. Physician-manned on scene care was found to cause a significant increase in scene time and total pre-hospital time. These delays are associated with an increase in the risk for death in-patients with severe injuries (Sampalis, 1994). Physicians on the scene tend to try to provide more care in the field than well trained paramedics, therefore, the time to definitive care of the haemorrhage may be delayed (McSwain, 1995).

With the information available it seems that in an urban setting all that is required is a comfortable vehicle with sufficient space to carry the injured safely to a hospital.

Role of medication

Analgesics for trauma patients and cardiac drugs for non-trauma patients are the most commonly used medications. Fentanyl was used in 75.4 per cent of patients with fractures during transportation to the hospital (DeVellis, 1998). Drugs were administered in 8.5 per cent of urban emergency patients and 7 per cent of rural emergency patients either at site or during transportation (Moss, 1993). So far, there is no reported evidence that pre-hospital medications are either beneficial or cannot be delayed until the arrival at the emergency room.

Care of wounds

antiseptics and antibiotics are not necessary for care of wounds. All that is required is to keep the wound clean. Healing is a natural process, which cannot be hastened by any medicine and ointments can only delay healing. In case of small wounds if the wound is dirty then the best treatment is to wash the wound with clean water. This is the only first aid that may be required for small wounds and abrasions.

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Splints for the injured

Fractured/dislocated limbs can be splinted to help reduce pain and prevent further injury to the patient. This is an important first aid measure and must be attempted on scene to make the patient more comfortable. All kinds of materials can be improvised to work as splints and if nothing is available the opposite uninjured limb of the patient can function as an effective splint. Air splints are available which encircle the limbs and compress tissues. These can cause serious damage if applied too tight. Softer easily available materials like cushions, pillows

or even rolled up magazines and newspaper may be equally effective without causing further damage.

Care of the spine

Recognizing a spinal injury is not easy even for trained medical personnel. However, a high index of suspicion can prevent paralysis and further damage in a spinal cord injured patient. Spinal cord injury must be suspected if the patient has a head injury, is unconscious or has altered sensorium, has paralysis of the limbs or is complaining of pain in the neck or back. There is, however, significant variation in clinically clearing cervical spine practice among emergency duty physicians (Cone, 1999).

If spinal cord injury is suspected then the best first aid is to treat the patient as a 'log of wood'. All movements of bending, extending or rotation is to be avoided. Four or five persons can together transfer a patient as a 'log of wood'.

A semi-rigid collar for the neck or even a simple rigid board can be used for shifting the patient. Repeated transfer of the patient is to be avoided in all patients suspected to have spinal cord injury.

ATLS vs BLS

In the mid-seventies, cardiac patients were found to do much better with the availability of ALS care. It was assumed, therefore, that all patients would do better with more being accomplished on the field (McSwain, 1995). This assumption neglected a basic premise of patient care: *the most important factor in patient survival is the time from the onset of the emergency to the provision of definitive care*. There has been a lot of controversy about the value of ATLS for injured patients (Trunkey, 1984). ATLS involves a greater use of technology, psychomotor skills and medication for pre-hospital care.

BLS on the other hand focuses on basic airway support, control of bleeding, immobilization of spine and provision of supplemental oxygen when required.

In a sample of 360 severely injured patients Sampalis (1993) found that the outcome of trauma is not affected by ATLS on the scene. Cayten (1993) also found no benefit from the use of ATLS for trauma patients with pre-hospital times less than 35 minutes. This was also reported by Adams (1996) and Sampalis (1994). Jurisdictions throughout the US and some other parts of the world have invested substantial time and resources into creating and sustaining a pre-hospital advanced life support (ALS) system without knowing whether the efficacy of ALS-level care had been validated scientifically. The strongest support for ALS level care was in the area of responses to victims of cardiac arrest (Bissell, 1998). Sampalis (1992) reported provision of ALS on scene was associated with a higher incidence of mortality where as definitive care in level 1 or 2 compatible hospital was associated with a lower mortality.

'Scoop-and-run' versus 'stay-and-stabilize'

There are proponents for and against each of these approaches. 'scoop-and-run' involves extrication of the patient, maintenance of a clear airway, protection of spine and control of haemorrhage whenever possible. 'Stay-and-stabilize' on the other hand involves

placement of intravenous lines, infusion of intravenous fluids, application of PASG and endotracheal intubation whenever required.

A review of literature and the physiological processes involved suggests that in urban areas with transportation times of less than one hour and no delay in extrication scoop-and-run seems to be the best policy.

Backup at the hospital

All hospitals do not have the same level of expertise for managing trauma patients. Unnecessary shifting from one hospital to another hospital can be avoided if proper triaging is done in the beginning. The quality of a trauma system can be assessed by the rate of preventable deaths. One question that can help is if this patient had sustained the accident in front of the hospital in a normal working day, might death have been prevented? The main failures in a review of trauma deaths were found to be errors and delays during the first phases of in-hospital assessment and care. An improvement in pre-hospital care will be almost useless if the quality of definitive in-hospital management is not addressed (Stochetti, 1994).

FUTURE

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We are in a situation where something as basic as starting of an intravenous fluid in a traumatized patient is being labeled as controversial. Factual meta-analysis needs to be done to separate what really works from what is perhaps useful. The future may find that even some of our very basic parameters of measurement of end points of resuscitation may have changed completely.

One of the dilemmas of pre-hospital care has been 'are we doing too little for a damage which seems too much?' Our emotional response seems correctly to be to do whatever possible to save as many lives as possible. There is a need, however, to avoid deification of technology and to homogenize responses in a problem which is essentially heterogeneous. To make scientific conclusions we must have well-controlled prospective randomized studies. There exists a strong general feeling that randomizing pre-hospital care is unethical (Gold, 1987). However, there are natural control populations in place in the world where a total contrast of no pre-hospital care exists along with places where high-tech pre-hospital care is practised. Advantage could be taken of such situations, normalize them for different injuries to have a controlled study. Until such carefully designed studies are carried out we will continue to grope for answers and components of pre-hospital care will remains controversial.

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