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Changes in the Provision of Medical Care at Major Incidents

by

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Foreword

I am delighted to pen this brief forward to the first of our occasional 'Historical Insights' produced by members of the Institute of Civil Protection and Emergency Management's (ICPEM) Historical Special Interest Group (SIG). The Historical SIG has now established itself alongside several others as part of the growing benefits of ICPEM membership, but, as always, we are reliant upon members' contributions to maximise the benefits of the group.

We currently have four articles from members of the Historical SIG lined up for publication in future editions of the Institute's *Alert*! journal as well as forthcoming updates in each edition of *Communique*. Therefore, in order that members' articles aren't delayed for publication for too long, it was suggested that we also produce these occasional 'Historical Insights' for distribution to the SIG as well as posting them on our website as a permanent source of reference. To that end, we are extremely grateful to our good friend and colleague Dr Ken Hines for writing the first of our circulations – this time looking at historical developments in the provision of medical care at major incidents. I am sure that fellow members will find Ken's paper as fascinating as I did and will join me in extending our grateful appreciation for the time and effort which has clearly been put into writing it.

On a more general note, I was recently reviewing an academic paper on work intensification and ambidexterity in the ambulance service (Wankhade et al, 2019) and the resulting 'reference trail' then led me to a further article entitled 'Why resilience managers aren't resilient, and what human resource management can do about it' (Barnicki et al, 2016). I was particularly struck that this second paper reported amongst other things:

> "[resilience managers] can suffer from high level of workplace stress, struggle with issues of 'self-efficiency and self-determination' and lack 'resilience resources' such as social support and connection."

This, in turn, got me thinking about the supportive networks which are so important to us all in our personal and professional lives. Branicki et al (2016) go on to say "… one concrete way in which resilience managers' protective factors can be enhanced is via membership and participation in professional networks external to [their own] organisation that provide a supportive context and source of expertise, esteem and self-efficiency." Membership of the ICPEM – and both the Institute of Emergency Management (IEM) and Institute of Civil Defence and Disaster Studies (ICDDS) before it – has always been extremely important to me as it provides support from, and connection with, other like-minded professions in the field of emergency preparedness, response and resilience. Similarly, the Historical SIG provides a more focused network to support our professional interests and I look forward to seeing it grow in terms of both contribution to the Institute's aims and our influence on its activities. Against that context, please do encourage other colleagues who have an interest in the historical aspects of our profession to join the SIG and consider whether you could contribute an article (or two!) of your own for future publication.

In the meantime, my renewed thanks to Dr Ken Hines for his inaugural 'Historical Insight' and I look forward to our future contributions with great interest and enthusiasm.

Peter Davis
Chair, Historical SIG,
Institute of Civil Protection and Emergency Management.

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About the Author

A qualified medical practitioner since 1969, Ken Hines started out as a General Practitioner (GP) in East London and was an Immediate Care Provider in London and South Essex in support of the ambulance service. He is a founder and current member of the Executive Committee of the British Association for Immediate Care (BASICS), an organisation he has served for 42 years. In addition to being the Medical Incident Officer at a number of incidents, he has performed the role of Event Medical Officer at major events. Currently the Honorary Librarian and archivist for BASICS, he brings his vast knowledge of medical response to a wide range of disasters. Formerly a Fellow of the Institute of Emergency Management (IEM), he is a Founding Fellow of the Institute of Civil Protection and Emergency Management (ICPEM).

Changes in the Provision of Medical Care at Major Incidents

Introduction

The origins of pre-hospital immediate care are rooted in the Military traditions. The Roman Army, for example, had a small company of men walking behind every 100 or so fighting soldiers. They were tasked to pick up the injured and ferry them back to medical aid posts set up behind the battle lines. These were often run by the women folk. They would patch up those with minor wounds and get them back into battle. Little could be done for the seriously injured and often they were just left to die. This situation continued throughout the middle ages. It was not until about 1792 and the Napoleonic wars that Baron Dominique Jean Larrey (1766-1842), Surgeon in Chief to Napoleon's Imperial Guard, developed the concept of triage.[1] Triage comes from the French verb trier - to sort or sieve. The priority was to treat those that, after patching up, could be returned to battle. The more serious casualties that could benefit from an amputation were operated on in the field. Those with multiple injuries for whom little could be done were left and usually died. Baron Larrey is often also credited for forming the first ambulances; the ambulances volantes. Modern day triage prioritises the most seriously injuries as priority one, especially those needing life-saving surgery.[2] Whereas the walking wounded are priority three. In mass casualty situations, Larrey's approach of doing the greatest good for the greatest numbers still applies today.

The Royal Humane Society (RHS) almost certainly masterminded Britain's first network of doctors willing to give free and immediate medical care at the scene of accidents. Today the Society only functions as an award making body but its first 150 years of service has remarkable similarities with BASICS (The British Association for Immediate Care), the current day organisation of doctors and others voluntarily on call in support of the Ambulance Service.[3]

A hot bath for victims of hypothermia falling through the ice

The Royal Humane Society

The RHS was founded in London by two doctors, William Hawes and Thomas Cogan, in 1774.[4] It was initially known as "The Institution for Affording Immediate Relief to Persons Apparently Dead from Drowning." Within a few years, the Society had established more than 250 "Receiving Houses" or Emergency First Aid Stations close to lakes and rivers in London. These "Houses" were based in local pubs, tents, workhouses, police stations or purpose-built mini hospitals. The most famous was built in 1835 besides the North bank of the Serpentine in Hyde Park. It had accommodation for a Superintendent, and

lifeguards, plus two wards, a surgery and a committee room. Each ward had 4 baths and six beds. They were heated through a system of hot water pipes and maintained at a constant high temperature.[5]

Within a few years more than 100 doctors were freely offering their services in the London area and the movement had begun to spread throughout Britain and some other countries. During the late 1770s the RHS produced "guidelines" describing acceptable methods of resuscitation. These consisted of warmth; artificial respiration by mouth to mouth inflation with compression of the abdomen and chest; fumigation by the introduction of tobacco smoke into the rectum and colon; rubbing the body; stimulants; bleeding; and inducement of vomiting. By 1812 the Society was strongly advising against mouth to mouth resuscitation believing that the exhaled breath was poisonous. In 1823, RHS doctors were supplied with specially designed cases packed with resuscitation equipment. In 1861 a Dr Henry Sylvester joined the volunteer doctors, and the next year the Royal Medical and Chirurgical Society (now the Royal Society of Medicine) set up its first committee to study "suspended animation." They recommended both the method developed by Dr Silvester and another devised by Dr Marshall Hall. Today it is the European Resuscitation Council that sets the guidelines in Resuscitation. Mouth to mouth resuscitation, having come back as an important aspect of resuscitation has, in recent years, become less important than chest compressions. Fortunately smoke up the rectum is confined to the history books!

Morphine

Although Morphine was first marketed by Merck in 1827 it could only be administered orally. It was not until about 1853-1855 that the hypodermic syringe and needle were first invented and became available. These of course had to be washed and reused after autoclaving. The needles required regular sharpening. It was not for another hundred years that intravenous fluids could be given to casualties. Nineteenth Century rescuers relied on pouring water into a tube that trapped casualties could drink from. Hot sweet tea was used as a stimulant. Today it is considered bad practice to offer oral fluids to a trapped or shocked casualty.

The Regent's Park disaster 1887

It was on 15th January 1887 when the Royal Humane Society dealt with its first major accident. The Society's Icemen on duty at Regents Park had posted warnings to keep off the ice as it began to thaw. Despite this, several thousand ventured on to the ice, ignoring the warnings. By 3.30pm there were still about 300 people skating, with several thousand spectators. Suddenly the ice cracked and around 200 people were thrown off the ice into the freezing water. Many got trapped under the ice unable to force their way to the surface.[6] There were 18 Icemen in the park and a Mr Obie was the Society's Medical Officer on duty in a tent which functioned as the Receiving house, this had just one bath and two beds. Other doctors from the Society were called to the scene, and residents of Sussex Terrace who had a grandstand view of the disaster, sent blankets and sheets to the tent. Despite the limited resources scores of people were treated in the ninety minutes following the incident. Most casualties were warmed and dried and then sent home in cabs. Some made their way to a local pub for "restorative" treatment.

Breaking the ice to find victims of the accident

About forty casualties were so exhausted that they were admitted to the nearby infirmary at the Marylebone Workhouse or St Mary's Hospital Paddington. The workhouse doctors treated 16 casualties taken straight to them and one named James Cawley was close to death. Resuscitation using the Silvester and Marshall Hall methods failed and he sadly died.

That evening and the next day concentrated efforts were made to recover the dead from the lake. Nine bodies were recovered before dark. They were taken first to the Receiving House and then to a temporary mortuary established at the workhouse. Three days later a total of 40 bodies had been recovered from the lake. Three divers scoured the bottom of the lake, but no more bodies were found. The lake was finally drained to ensure no bodies had been missed.

An inquest was held at the Marylebone workhouse, presided over by the Middlesex Coroner Dr. Lankester. The lake had been up to 12 feet deep in places. A strong recommendation from the inquest was that the lake should not be allowed to be more than 4 feet deep in the future. The Illustrated Times of Jan 1861[7] reported:

> " From the commencement of the frost on the 17th December last to the present time , the total estimated number of skaters and sliders which have ventured on to the ice in the various Royal Parks and in Kensington Gardens is 170,000 of whom 160 have been immersed and rescued by the icemen employed by [the RHS] and then resuscitated by the excellent methods adopted by them; in addition to which nearly 600 persons have received surgical treatment at the hands of the medical officers of the society - some suffering from the most terrible burns, the result of fireworks and torches during the mad scenes enacted of a night on the Serpentine, others from every imaginable kind of broken bones, and the majority from sickening cuts generally of the forehead and eyebrows, making it a rather difficult operation for the surgeon to dress them."

Other incidents in the Nineteenth Century

In 1856 there was a serious crush at a religious service in Surrey Gardens in South London. As usual the local police called local family doctors to the scene. A local surgeon by the name of Otway was also called to the incident. Six dead victims were being placed on a table in the grounds. He confirmed them all dead but noticed one victim was in an advanced stage of pregnancy. She was taken to a nearby workhouse where another surgeon named Ganon performed a post-mortem caesarean section, but the child was still born.

Just two years later another crush disaster occurred at the Victoria Theatre, better known today as the Old Vic. Fifteen young lads died in a crush on the stairway. Again, local doctors were summoned to the scene. A St Thomas Surgeon, Mr Gervis, together with a dresser Mr Bone, tried to resuscitate two youngsters using galvanism, a device like the modern cardiac defibrillator, but were unsuccessful.

The dreadful disaster in Sunderland in June 1883 when 183 children were killed in a crush at a magic show, as they tried to leave at the end had many local doctors summoned. One of them, Dr Lambert, wrote to the British Medical Journal:[8]

> "I saw a sight in the half darkness of a heap of, as near as I can tell, about three hundred children, and most of them apparently dead. The heap was massed, I should think, seven or eight feet in height at the furthermost part; many of the children were down and others locked together in a manner almost inextricable; many seemed to be feebly struggling and moaning. Every moment lost meant many lives; indeed, I should think 100 died within the first five minutes after the rush occurred. I saw that I might be the means of saving scores of lives by trying to rescue the living from the dead, rather than any professional aid I might render; and I knew medical men must soon be on scene."

More doctors arrived quickly, some assisting separating the living from the dead, while others set up a triage point inside the theatre and tended to the injured. Dr Lambert recorded that one of the children was resuscitated by the "application of electricity." In his report to the BMJ Dr Lambert then described the condition of the victims:

> "In most cases that had advanced beyond the initial stage of suffocation, we noticed convulsive movements of the eyes and limbs and almost insensibility; but it was astonishing even in these cases, where we were only assured there was only a spark of life in them, how soon they would recover and, after a drink of water would walk away with a little assistance. The dead nearly all presented the same characteristic appearance, namely, a congested, puffy face, purple or blackish turgescence of the vessels of the neck, closed eyelids, protruding and fixed eyeballs, pupils dilated to the utmost, bloody froth from the nose and mouth, giving the appearance of an intense degree of suffering and anxiety; yet, in twenty four hours after death, much of this had passed off, and the face reposed into a slight smile as seen in sleep. Cadaveric rigidity was universally absent, the muscles and joints being extremely flaccid."

It should be remembered that there was no portable oxygen to take to the scene. The doctors could use the Silvester method of resuscitation, dress wounds and splint fractures, but little else in the way of interventions.

During the latter part of the 19th Century railway accidents were all too common and doctors as passengers often ended up tending to train crash victims. In the four years 1872-1875, over 5,000 people were killed

on the British railway network and nearly 17,000 injured. Often casualties were loaded onto another train and conveyed to various hospitals further down the line.

The Twentieth Century

The explosion at a factory manufacturing trinitrotoluene (TNT) in Silvertown, East London in 1917, was heard all over Greater London and reportedly as far away as Cambridge. The Royal Albert Dock hospital was inundated with casualties as was Poplar Hospital. The London Hospital also took a large number. In addition, the London Hospital sent a Mobile Medical Team and equipment to the scene. This would seem to be the first time such a formal team had been deployed, although not without its problems. The team were conveyed from the hospital to the scene in a taxi. As the taxi approached the scene, whilst still a mile or so away, the driver became scared and refused to go any nearer. The team had to get out of the taxi and walk the last mile or so, carrying their equipment.[9]

Debris spread over a wide area from the Silvertown explosion

This rather haphazard approach to pre-hospital care continued until the Second World War when a much more organised approach was required. Comprehensive emergency plans were drawn up for the bomb-stricken cities. A series of local control centres were alerted by air raid wardens. The control centres activated First Aid Posts (FAPs), and ambulances and fire services responded as necessary. General Medical Practitioners played a major role in rescue work and at FAPs. The Civil Defence arrangements were the forerunners of modern civil emergency planning. One of the civil defence training manuals published in 1949 and called “Basic Rescue” had many important principles still relevant to rescue today especially in relation to the bombing of buildings by present-day terrorists.[10]

A World War II First Aid Post

Although 1948 saw the beginnings of the National Health Service, the first official guidance from the then Ministry of Health about major accidents did not appear until 1954. It was a small sized pamphlet.[11] Compare that to the most recent version on computer of more than 100 pages of A4. Although the title of the senior doctor at the scene has changed over the years, the roles and responsibilities have remained much the same. The 1954 document described a Medical Officer, thereafter they were variously called the Site Medical Officer, the Medical Incident Officer, the Medical Incident Commander and most recently the Medical Advisor.

The acknowledged father of modern pre-hospital medical care was Dr Kenneth Easton, who left the Royal Air Force at the end of the war to become a family doctor in Catterick, North Yorkshire. Ron Exelby, a close friend, who ran a haulage business, put together a crane, chains and a crude range of tools including hacksaws and jacks as rescue equipment.[12] These two and a local policeman began to attend serious road traffic collisions on the stretch of the A1 near Catterick. At that time the Fire Service was not responsible for the rescue of persons trapped in road accidents.[13]

A railway accident in Sutton Coldfield on the 23rd January 1955 was the impetus to start a hospital based flying squad at Derby Royal Infirmary.[14] The York to Bristol Express, diverted from its normal route because of engineering works, went through the station at twice the permitted speed. The engine overturned and the carriages piled into it. Seventeen passengers and the enginemen were killed and 23 injured. Local taxis provided transport at first for the flying squad, then, the Derby Borough Police took over the responsibility. Today they have their own dedicated vehicles. In early 1960, Mr H.M. Hall started a similar hospital-based team at Preston General Hospital.[15]

In Germany Professor Eberhard Gogler[16] at Heidelburg described a “therapeutic vacuum” as being the time wasted between an accident occurring and medical care commencing. He developed mobile operating theatres which were strategically placed along motorways ready to respond to any serious traffic accident. In 1964, the Birmingham Accident Hospital used a mobile operating theatre, like those used by Gogler, but the concept was short lived and was soon abandoned. William Gissane, one of the early advocates of the British Accident Services claimed, “the place for surgery is at the hospital and not at the roadside.”[17] A debate began that has lasted for more than 50 years and is still controversial. Today, in the pre-hospital environment, chests are being opened for penetrating stab wounds to the heart, brains are being decompressed, and limbs amputated if necessary. In 1970, a leading London Accident and Emergency (A & E) Consultant told the author that he was criminally negligent if he put a drip up outside hospital on a

patient with multiple injuries. It was dangerous and should only be done by a hospital doctor. The same consultant argued that the ambulance service should convey all the victims of a major incident immediately to hospital and all triage would be done at the hospital. Fortunately, few agreed with him!

At the Harrow and Wealdstone train crash in 1952, valuable help was given by medics from the 494th US Army Medical Group from the USAF Hospital Station at nearby South Ruislip. They brought to the scene, and used, intravenous fluids and plasma, although the plasma was contained in glass bottles and had to be mixed on site. This undoubtedly saved lives and the UK emergency services were most impressed. A few months later, in East London, British medics from Queen Mary's Hospital did the same thing at the Stratford train crash with significant benefits. The advent of plastic bottles and giving sets made the placing of canulae and the giving of fluids very much easier. O Negative whole blood was used at the Clapham train crash in 1988, 4 units being given to a trapped casualty to maintain a systolic blood pressure of around 90mm mercury.

Ketamine has found a place in prehospital care. It was first available in the USA in about 1970 and was very successfully used at the Moorgate Train crash in 1975 to anaesthetise a patient whose foot had to be amputated. It is now routinely carried and used by most pre-hospital care practitioners.

The 1980s was a decade of disasters but also one of change in the Ambulance Services. Ambulance men and women progressed from the very basic Miller training to extended training, then paramedic training, which in turn has become a university discipline. Today we have consultant paramedics and paramedic practitioners.

Following the report by Lord Justice Hidden after the Clapham train crash, BASICS doctors organised an annual training course lasting 3 days at the Hammersmith Hospital. This was the first occasion on which doctors were taught specifically about major incident management and predated the Major Incident Medical Management and Support (IMMS) training.

Anaesthetic skills have also been routinely used in the last 30 years. The use of rapid sequence induction to anaesthetise patients is standard practice. Patients with head injuries and a Glasgow Coma Score of 12 or less are now often paralysed and ventilated at the scene before transportation to hospital, frequently to a specialised trauma unit by helicopter rather than land ambulance.

Today's paramedics can do many of the medical procedures previously only performed by doctors. They also have a range of drugs that they can use within certain protocols. Victims of a major incident have never had a better chance of survival. Immediate care practitioners and paramedics can form a formidable team when working together under pressure. There are still some issues to resolve. Protective clothing is now accepted as the norm and indeed anyone not properly dressed for the potentially hostile environment should not be allowed to access the scene. Most available kit is ideal for the cold, wet and inclement conditions that so often prevail at the scene of accidents in the United Kingdom. However, there is no suitable kit for working in very hot conditions, perhaps in the sun on a hot summers' day, or on the underground system.
Because of the problems of using blood, the search has been on for many years to find a fluid that can be infused safely that has oxygen carrying capacity but so far there is nothing routinely available yet.

Progress has been made with the problems of massive haemorrhage and, thanks to developments in the military, blood clotting agents are now available to pour into wounds that are bleeding uncontrollably. The tourniquet has made a return, but with very careful instructions about its application and release.

Portable, ultrasound scanning equipment has enabled better onsite triage so that the patient, with a possible ruptured spleen confirmed by ultrasound, can be dispatched quickly to a hospital capable of doing immediate surgery, and the patient suffering from extradural or subdural haemorrhage can be sent direct to a neurosurgical facility. The ability to rapidly transmit photographs of injuries, particularly the problems related to crush injuries, to staff at the receiving hospital means a much better understanding of the clinical problems. Portable ultrasound cannot rule out an injury but if positive enables better triage. In the last few years it has become possible to successfully treat a traumatic cardiac arrest, something that 10 years ago was universally considered a futile exercise. Pelvic splints are now available to help manage the fractured pelvis and to control blood loss and shock. Splinting of fractures has not really progressed, and the trusty triangular bandage still has a very important role.

What are the possible future developments that will assist the prehospital medical care of casualties?

The transport of patients from where they are injured to an awaiting ambulance has remained largely unchanged for the last 100 years. The Furley stretcher still plays an important part. This requires 4 people to carry it safely over rubble strewn ground or other uneven ground. The possibility of utilising "Hovercraft" technology might assist in providing a safer and more comfortable carry from the wreckage to an ambulance. This has been tried in the past by the British army[18] but not adopted. A further device, the Hoverjack 2, did not catch on but improved, more modern technology suggests this could be reconsidered. Inflatable splinting devices fell out of favour due to their misuse. But the whole issue of splinting is unsatisfactory and there is scope for new methods of splinting fractures, both to minimise pain caused by movement, and the risk of neurovascular damage from pieces of bone,

Conclusion

No two incidents are ever the same, there may be common threads, but the challenges will continue. The principles of protect yourself, protect the scene, deal with the casualties and look at the quiet ones first will always apply. The next phase is to get the right casualty, to the right hospital facility, in the right time frame. How that is done is an area ripe for research and development. Enormous progress has been made in the last 50 years and the next 50 years promise to bring many new developments. The use of Helicopters in pre-hospital care is developing rapidly and they now routinely arrive at major incidents with highly trained practitioners on board. Most of the helicopters are registered charities, the crews often volunteers. Their similarity to the Royal Humane Society volunteers is striking.

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Historical Special Interest Group

The objectives of the Historical Special Interest Group (ISIG) are to:

1. Further the understanding of the history of crises, disasters and emergencies, by:
   (a) encouraging study and research;
   (b) promoting the collection of historical accounts of past crises, disasters and emergencies;
   (c) publishing historical accounts of crises, disasters and emergencies.
   (d) providing advice on historical aspects of crises, disasters and emergencies;

2. Proactively promoting the Institute as a historical source through delivering presentations and attending relevant seminars and conferences.

3. Assisting and supporting the Institute's Mission and Vision by providing a representative forum for historical activities, including, where appropriate, the submission of research and other relevant articles to the Institute's publications.

4. Developing a repository of historical accounts within the Institute for the benefit of members.

5. Bringing to the notice of members historical sources of all aspects of civil protection and emergency management from which lessons can be identified.

6. Reporting on the key activities of the Historical SIG to the Executive Council of the ICPEM.

Anyone interested in joining the Institute's Historical Special Interest Group should contact the Group's General Secretary, Tony Moore at tmdisman@gmail.com for further details.