Protocols for Documentation of Electrical Injuries for Electrical Safety Inspectors and Emergency Medical Practitioners

by

Christopher J Andrews
BE MBBS MEngSc PhD JD DipCSc EDIC GDLP ACCAM
MACS SMIREE SMIEEE FACLM
Associate Professor, Faculty of Medicine, University of Queensland
chris.a@pobox.com

Dorin Panescu
BSEE, MSECE, PhD, FIEEE
Zidan Medical, Inc., San Jose, CA, USA
panescu_d@yahoo.com

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ABSTRACT

Type of Study: This is a paper providing guidelines for medico-legal reporting.

Background: Electric shocks are common, and victims report difficulty in finding practitioners with knowledge of the injury. Medical Practitioners, especially in private practice, report lack of knowledge of the injury and lack of expertise in assessing and treating the injury. The authors are often requested to suggest investigation protocols, assessment protocols, and treatment protocols, and to provide educational information.

Methods: The international body establishing electrical standards on the effects of current on the body (International Electrotechnical Commission, Maintenance Team 4 (MT4) of Technical Committee 64 (TC64)) have established protocols for the factors which require documentation and reporting of the injury. This paper provides a narrative approach to using these protocols in accord with the standards (IEC 60479). The level of evidence is Level III (US/Canada classification).

Type: This paper collects together and collates physical and medical aspects of investigating electric shocks, and summarises those of importance, and which are potentially forgotten. The thoroughness of initial assessment is emphasised.

Substance: Summaries are set out to guide first attenders and emergency medical personnel as to findings and observations which must be recorded for later comprehensive medico-legal reporting and which are often overlooked.

Conclusions: Wider teaching in the nature of electric shocks will enhance assessment of victims and thorough recording of pertinent information and thus will enhance later medico-
legal reporting. Many such factors are initially overlooked and lead to inadequate reporting for forensic purposes.

Keywords:

Electrical Injury, Protocol, Investigation, Treatment, Emergency.
Introduction

Reporting on, or investigating, an electrical accident may be required for several different purposes. A report is often requested for medico-legal purposes and the assessment requested will form part of the litigation process. A suitably qualified person may be asked to provide advice and treatment of a disabled person some time following a shock. On the other hand, investigation may be required on a statutory basis, to establish events relevant to future system design, or for documentation of faults leading to an accident.

Both authors are members of the International Electrotechnical Commission (IEC) maintenance team (MT4) which produces the standard IEC 60479 1-4 in four parts and associated technical references. The team comprises both technologists and medical practitioners and it is part of the broader Technical Committee 64 (TC64). MT4 is often asked for recommendations for important investigatory points, and also assessment recommendations, for electrical injuries. The team has adopted a statement for both technical investigation, and also medical assessment, and this paper provides a narrative presentation of these recommendations.

The process of each is broadly similar, and they inform each other. Firstly, a thorough assessment of the physical circumstances of the shock occurs. Of particular importance are cases when the electrical shock resulted in life-threatening or fatal injuries. This involves documenting the mechanism of injury, and an assessment of the current path through the victim. This is fundamentally a bioengineering assessment and requires a thorough knowledge of electrical science and the interaction of current with the body. Such an assessment will document the mechanism by which current passed through the body, or
alternatively may find that no such pathway was possible\textsuperscript{5}. The second is an assessment of the consequences of the shock on the victim’s mental and physical health. This is provided by qualified persons capable of a medical assessment and familiar with the injury. The first is most often carried out by statutory inspectors and qualified engineers, and the second by medical practitioners acting in a medico-legal capacity.

The ultimate goal of comprehensive reporting is the answering of questions like, “\textit{was this person cogently subject to an electric shock}”, “\textit{were there electrical faults involved}?” , “\textit{what was the shock mechanism}?” , and secondly “\textit{are the symptom consequences consistent with the effects of such a shock}”? These questions satisfy statutory requirements and also legal questions in a tort proceeding\textsuperscript{6}, namely “\textit{was there an injury}” and “\textit{are the consequences claimed likely to arise from that injury}”. The legal process then goes on to examine other factors, including duty of care, breach of duty, and so on\textsuperscript{6}. But the initial questions are provided largely by expert reports, and it is to these that the attention of this paper is directed.

The task of providing these reports (technical statutory report, and medical report) can be difficult, especially the medical report. An expert isExperts are called on to provide both these reports together, several years after the initial injury, and thus special expertise is required. By that time many pertinent facts have been forgotten, or have become otherwise inaccessible to the reporter. There are likely to be gaps in the initial investigations, and thus reports written in terms of likely probability have to be given. Further, in a Bayesian fashion, individuals and bystanders will present different histories of the event after the passage of time\textsuperscript{7}, and their accounts will change with time and personal expectations. This does not imply malice, but is a natural consequence of an individual’s reaction with time to a baffling and unfamiliar event.
The importance, therefore, of the investigation by first responders cannot be overestimated. Similarly, the important role of first assessors is crucial for those coming after, and often substantially after. Documentation is crucial. Very often the first investigators of the engineering aspects will be power authority personnel, and the first assessors of the injury will be emergency medical personnel. As well as the reporting, treatment is implemented immediately following the injury.

In providing any report, and also in providing treatment, the fundamental questions are:

- what has exactly happened?
- how did it happen?
- what equipment/devices were involved?
- what were patient’s presenting symptoms and status when the emergency medical responder first encountered the patient?
- what was the clear, unbiased, medical evidence collected by the medical responder, at the emergency room or in hospital, and is there any influence of relevant medical history?

The authors are regularly asked, as is MT4, for guidance as to what are the key points to elucidate in a technical appraisal, and are also asked to provide guidance regarding the medical assessment of the injury.

Thus, this paper has several aims:
i. To provide guidance, in the light of years of experience and large numbers of victims, of those items which are important in the first engineering examination of the accident;

ii. To provide a protocol giving those factors which are important in the first medical assessment of a victim;

iii. To answer questions regarding a recommended protocol for the immediate assessment and treatment of victims.

An initial comment regarding terminology is necessary. There is a general tendency to refer to such incidents as “electrocution/s”. This term implies death from electric shock. A live patient has not been electrocuted, but has suffered an electrical injury. This terminology is used throughout this paper.

**Initial Incident Investigation**

The initial meeting with an electrical accident victim involves two important groups. First, the victim will be given first aid, and transported to a medical emergency facility. Bystanders will generally be able to give an account of events, and the victim will be able to be interviewed when stable. Second, according to regulatory requirements, authorities will need to be notified, and inspectors will investigate the circumstances of the shock.

We concentrate on the inspectorial investigation first. We suggest those matters which the authors would wish to see when required to make a report at a later date. Documentation of the first assessment derived from first response is crucial, both physical and medical.
Factors for the first responders to document follow.

Initially demographic and identificatory data must be recorded. Box 1 shows the basic parameters which are in common with most injuries.

The physical circumstances, and their context are documented. This allows the apparatus with which the victim made contact to be determined. Box 2 documents important items.

The aim of examining the physical circumstances is to allow the assessment of the likely current through the victim, and to choose which sections of an appropriate standard will apply to these assessments. The standards are the IEC 60479 series\(^1\)\(^-\)\(^4\), and often in the common scenario, IEC 60479-1\(^1\). This allows assessment of body impedance for the likely body pathway, and also gives criteria for the assessment of danger thresholds for current in that path.

Body current can be calculated using Ohm’s Law from the voltage applied across the body’s contact points, and the impedance of the body in that path. It should be noted that the applied body voltage is not necessarily the source voltage. The source impedance must be taken into account\(^7\). The current capacity of the source is mostly irrelevant to this calculation\(^2\).

The assessment of the physical current pathway is most important. It allows a search for burns at contact points, and also defines a pathway between these. This allows entry into the standard to assess danger thresholds. The pathway directs a search for internal burns, and also the degree to which the heart and respiratory apparatus may be involved. Naturally the greater degree to which the heart is involved in the pathway defines a greater danger of
ventricular fibrillation (VF), a fatal rhythm disturbance in heart action. In short, a circuit must be found whereby the victim forms part of that circuit for the conduction of current. “Circuit is everything”.

Alternating current is the most common form of domestic/industrial voltage supply, and in this mode of current transmission, current flows to-and-fro in the circuit in a cyclical fashion. In any current passage moving electrons form a current. The aim of current flow is to perform work of some sort, often by collision of the electrons with the matrix of the material through which it passes. Alternating current (AC) is effective for this, and is also effective in being transformed in level for transmission and use. Nonetheless there are more modern applications where other types of current or becoming important. Direct Current (DC) for example, where electrons flow in one direction only, is equally capable of performing work, but is not as amenable to transformation and distribution. This discussion is confined to AC.

Given that AC flows alternatively forward and backward, the notion of entry and exit points for a body is not immediately relevant. In DC, a current can truly be said to enter a point of the body, and leave via another. These may be identified as entry and exit points, though the distinction is still somewhat academic. With AC neither point is truly a current entry point or exit point, though the damage to intermediate tissue may be equally severe. Thus, with AC contact points are referred to rather than entry and exit points.

In most AC supply systems two conductors are required from the system and, between these, a useful engineering circuit is derived. One of these is solidly connected to the earth (earth being regarded ideally as an infinite source of electrons and capable of “absorbing” electrons in any number – this idealisation requires modification in the real world), and this is done for
technical reasons of system reference and stability. The conductor connected to earth is termed the “neutral” conductor, with the other being termed the “active” conductor. Thus, an individual may receive a shock – become part of a circuit – when their first contact point is the active conductor, and the second contact point is either the neutral or earth, or points derived from these. Alternatively, shocks can be generated by contact with two active points, such as in the case of multi-phasic equipment, or floating, but high-power, equipment. Simply, a potential difference between the two contact points is required. Earth includes metal framing, and mountings which are also variously required to be solidly connected to earth electrically. This includes construction materials, for example, concrete flooring with metal bars embedded, door frames mounted on concrete, and metal parts of structures, and especially metal parts of electrical installations like switchboard frames and equipment mountings and cases. Particular attention should be paid to sensitive contact areas, such chest region around the heart, head, and neck, etc.

The search for contact points will require search for bare body parts in contact with these or their derivatives. Common sites include the hands, the knees if bare and the victim kneels, metal components in clothing like steel boot-caps, bare flesh of shoulders or arms on which the victim may lean, thighs where the victim bends over a bench or table, and similar contact. While bare flesh is a most important contact mechanism, the possibility of contact through wet or sweaty clothing must not be overlooked, hence a detailed description of the clothing at the time. High-voltage equipment may be capable of producing arcing through clothing items. Hence, contact may not always be directly to individual’s body. The clothing should be retained.
Thus, the importance of the victims clothing can be seen, along with flooring and other earthed contacts, and the general surrounds, along with the victim’s activity at the time. These should be thoroughly documented.

The preservation of the agents of the shock are particularly important. Too often one sees the disappearance of a likely injuring tool, or similar, which precludes definitive examination. Preserving these devices and submitting them to professional examination is invaluable. A chain of custody should be instituted, and formal reports obtained. For each such device, make, model and serial should be documented if available. Electrical testing in a certified lab is most important. The device’s maintenance history should be obtained, as well as any history of other shocks – even if not formally reported – in the same environment.

At all times photographs of the circumstances, including the contact details, should be made. We do not explicitly discuss the case where a victim is killed by electric shock, however in that case, the electrical inspector will be the only responder that, in reality, appraises the event. Photographs are especially important, and further, the report of these particular first responders are all the more definitive.

Various other observations may be required if the victim is deceased. The requirements of the jurisdiction of the investigator should be ascertained. As such a person will not come to the attention of practitioners in emergency care, the licenced inspector will need to request any required samples from a Forensic Laboratory. This may include alcohol and drug assays, hair and nail samples, temperature measurements, and other body fluid samples as may be dictated. Formal autopsy may be required.
A “Crossover” Region

To aid treatment, a medical practitioner will wish to obtain relevant history from the inspectorial investigator. Vice versa, some medical aspects are of importance to the inspector for comprehensive reporting. Cross-communication is important and this identifies “crossover” interest between these two teams. These are documented here as part of the interface between engineering and medical assessments. Box 3 documents some of these crossover factors. Not all of these will be immediately available, and will only become known progressively as contact is made with relatives, workmates, and the patient as he/she becomes conscious and responsive. The first engineering responder should document these, but it is crucial for medical personnel to record them and consider them. A later reporter will wish to comment on any specific susceptibilities the victim may have.

Further, special items like pacemakers, ICD devices, and other implanted devices, need to be known and documented. These devices can record logs of rhythm and activity at the time of the shock. It is extremely helpful for these logs to be made available from the time of the shock onwards. It is self-evident how valuable the logs are. They may show triggering arrhythmiae, and automatic responses instituted and monitored by the devices. They provide otherwise unobtainable evidence. Such logs may be obtained by download and printout and identifying information from manufacturers will be required.

Some jurisdictions require the estimation of blood alcohol levels and evidence of any drug ingestion. The obtaining of these will become a matter of request to medical staff if there is not statutory authorisation for the obtaining of these by the inspector. Chains of custody will be initiated.
Psychiatric past history is important in two ways. Firstly, the implications for any psychiatric aspects of the trauma must be considered, and secondly any influence of abnormal behaviour on promoting the accident must be considered.

A summary of items to be considered especially, and which require quick action to obtain, is shown in Boxes 4 and 5.

**Medical Management.**

The writers are often asked, both by patients and medical practitioners, for advice on assessing this injury. This seems derived from two sources, namely that victims find it hard to identify a practitioner with knowledge and skills in this area, and that medical practitioners are not knowledgeable or lack knowledge in the nature and treatment of the injury. In the latter case, this is a matter of teaching and exposure.

The spectrum of findings in electric shock have been well set out\(^9\)\(^10\). It is surprising to many that as well as the physical symptoms and signs, a proportion of victims show distinct and disabling psychological symptoms and signs. Thus, a victim often consults practitioners without knowledge in the area, and they are reassured of quick recovery in short order, based on more anecdotal reports. This is generally not the case for any but the most trivially injured, and the unwarranted reassurance does little to allay depression and anxiety when recovery does not occur. It is the subjective experience of one author (CA) that following a shock, the condition deteriorates for 18 months to 2 years, and then begins to show improvement. The improvement continues till the 4-5 year mark where it has plateaued short of the 100%
function once enjoyed. The implication also is that a reporter cannot indicate that the injury is legally stable and stationary inside that time.

In this paper, we suggest emergency management as this has been flagged as the area most in need of exposition, and then mention longer term management.

The normal scenario is that a victim will receive a shock, ambulance or personal transport will be called, and transport, possibly under monitoring, to a hospital will occur. Resuscitation and primary treatment may have been undertaken, and the victim may even arrive artificially ventilated.

For a reporter, medical or statutory, obtaining records of this transport will be important (see box 5). Box 6 summarises records which will be advantageous to obtain – and these form joint interests for the medico-legal report writer, and for the inspector.

Matters to be attended medically follow and are managed in order of priority, which in turn is determined by the injuries sustained. Treatment is dovetailed by emergency personnel. However often an initial presentation to a private practice may be the first medical contact for those less acutely injured. These remarks may inform both. As in all treatment, documentation is highly important.

a) Emergency Treatment

Emergency Treatment follows standard protocols. Monitoring is established urgently in parallel with emergency treatment of abnormal cardiac or respiratory states and
cardiac support and intervention, ventilation, and subsequent possible Intensive Care admission, may be required. Cardiac and respiratory interventions follow standard courses, and there is no special management of these due to their electrical origin. Nonetheless it is known that defibrillation from electrical VF is easier than that from other causes.

b) Urgent Treatment

Fractures and traumatic injury, possibly threatening the cervical spine and cerebrum, are dealt with in their priority.

Burns are perhaps the next order of attention. Photographs of skin markings should be obtained. The matter of whether there is any particular histological appearance of an electrical burn/marking remains controversial. To the authors’ knowledge there is not reliable index which is pathognomonic of an electrical skin burn/marking. Judgment regarding excision and/or grafting of contact areas should be exercised. Of particular interest is the depth of penetration of such burns, particularly in cases when cardiac effects are suspected. Was the burn deep enough to reach close to excitable cardiac tissue? Deep penetration also bypasses the large component of body impedance which resides in the skin, and increases pathway current.

Internal burning is a known phenomenon, involves muscle tissue, and can lead to compartment syndromes. Surgical release may be required. Fluid management follows standard burn procedures. This is not to be confused with the phenomenon of
keraunoparalysis in lightning injury\textsuperscript{11} however apart from flagging the difference, this is beyond the present scope.

Compartment syndromes take time to develop. Indices of suspicion of their occurrence, and also of internal burning, should be maintained. These include assessment of the current path for the likely site of muscle masses, and this is also supported by the presence of the contact points. Developing pallor and diminishing pulses and perfusion raise suspicion. Urine should be obtained and the presence of myoglobinuria also raises suspicion of muscle damage\textsuperscript{12-14}, along with electrolytes. Increasing Creatine Kinase (CK) also raises suspicion\textsuperscript{15}.

It is considered that the blood stream is a strong conduction path, as is muscle tissue. Nerve tissue is not considered to be a prime conducting path\textsuperscript{16}. Thus signs of haemolysis constitute an index of vascular current passage.

Alkalisation of urine\textsuperscript{12-14} is somewhat controversial. It has been stated that the effects of myoglobin and its renal toxicity may be ameliorated by alkalisation of urine. In fact, it is likely that the diuresis of fluid input flushing myoglobin may be more efficacious, and the addition of a small degree of bicarbonate helps clear toxic myoglobin breakdown products. It is stated however that only rarely does acute renal failure supervene\textsuperscript{13}. The presence of myoglobinuria, however, raises suspicion of internal muscle burns.

Attending to these more emergency and urgent features generally indicate the more severely injured end of the injury spectrum. Fortunately, these are in the minority.
Management of these cases proceeds along standard multiple trauma lines, without major factors due to the electrical origin of the trauma, except as indicated.

c) “Common Presentation”

The more common presentations form a spectrum. These range from those who are asymptomatic and apparently unaffected and who are anxious to be discharged to “get on with life”. On the other end of this spectrum are those who are clearly affected (anxiety, tachycardia, fright, and congeners) but who have no major overt immediate physical signs. Box 7 shows special aspects to be incorporated into a standard medical approach of history and examination.

Each of these require an ECG at minimum. The guiding principle is that a person with a normal ECG and blood pressure and no other sign of injury may be confidently discharged. Nonetheless close interpretation of the ECG is required for subtle changes, for example QTc interval. The question of delayed cardiac rhythm abnormalities, the worry being that they are fatal, has been raised. One author (CA) has only seen this phenomenon very rarely in over twenty-five years. Fatovic regards the phenomenon as extremely rare, and if it occurs is portended by initial ECG abnormalities.

Delay in onset of physical symptoms otherwise is well known in electrical injury, and follow-up assessment should be arranged. In particular symptoms of weakness, paraesthesia, and easy fatiguing of musculature is known, and treatment of these has
been dealt with elsewhere\textsuperscript{16}. Our present focus is establishment of protocols to ensure their recognition and recognise their importance.

Important items in the history of an electrical injury, in summary, are shown in Box 7.

The most difficult feature, and the one that is most surprising to most people, is the development of neuropsychological symptoms\textsuperscript{22,23}. The psychological syndrome is well documented associated with an electrical injury\textsuperscript{22,24-29}. Unfortunately, however, victims seek treatment from practitioners ill prepared and lacking in knowledge in this syndrome and are either dismissed as malingering (which phenomenon is relatively rare\textsuperscript{16}) or are fobbed off with incorrect reassurances of quick recovery. Despite the longevity of symptoms and their intensity, even specialist assessors make such assessments, which, when they do not eventuate, leave a strong psychological legacy. It is indeed considered that the psychological disability is more disabling than the physical syndrome\textsuperscript{30}.

The immediate issue for this paper is to identify ways in which this syndrome may be recognised, and early enough to initiate therapy. Some means of “catching” patients who have presented especially in the “common” category, needs to be identified, as onset is often delayed.

A first approach is to assure victims that if they find themselves developing further discomfort they will be taken seriously and supported. Secondly input from workmates to employers and/or Workers Compensation organisations should also be taken seriously and prompt review. It may be appropriate for individuals to be seen at
least once within the three months’ period following the accident. There is a need for assessment by practitioners who have made some study of the injury, and are familiar with it. (Helpful broad references exist\textsuperscript{6,31})

It is not known what percentage of victims will develop psychological disability, although it is only a proportion of all those injured. The present authors see those who are on the severely injured end of the spectrum, and this no doubt inflates perception of the incidence of psychological problems. Nonetheless, these often suffer prejudice and dismissal which more pervasive knowledge would ameliorate.

Comments on Report Writing.

Having accumulated the material referenced above, general comments on writing reports on these injuries can be made. Medico-legal reporters will be asked to prepare an evaluative report assessing an injury for forensic use. They may also be asked to comment on other reports already obtained.

In each case opinions must be well justified by findings and also reference appropriate literature. Knowledge of the injury is most important, and qualifies the reporter.

A general comment is paraphrased below\textsuperscript{23}, and applies especially since there are no published criteria for diagnosing the injury until recently.

\textit{It is usual that many individual examiners in different defined specialties are engaged, based on a prejudice as to which systems are involved. It is important to}
note that one reporter reports on one particular facet of the total injury alone. For example, a neurologist will report merely on neurological symptoms and signs; an orthopaedic surgeon on orthopaedic aspects alone; and so on. This is understandable, as anything beyond this is, for any individual reporter, outside their area of expertise. It is important to note that proper examination of electrical physics and mechanisms is almost entirely beyond any medical reporting, given at best a very perfunctory study of electrical physics undertaken by most practitioners. It is thus rare for there to be any report on the totality of an electrical injury. For most specialists, electric shocks and indeed trauma generally, within that discipline, are only a very small part of the discipline compared with the large range of diseases otherwise dealt with.

When diagnostic tests are conducted, and reported on, whether such diagnostic tests actually assess the area thought to be the site of damage needs to be considered. This applies, for example, to Nerve Conduction Studies, CT scans, and MRI scans, among others.

Regarding diagnoses, and in particular psychiatric diagnoses whose criteria appear in the Diagnostic and Statistical Manual for Psychiatry, one constraint is that experts are constrained by existing and known diagnosis in their disciplines. Thus, in psychiatric terms, PTSD, Adjustment Disorders, and so on, will be seen. While there may be elements of these, there is more to the injury than the current diagnostic framework allows. The diagnoses given are usually “as close as we can get” while remaining true to current criteria. They should not be regarded as final or comprehensive.
The message is that any reporter must be honest to the limits of their own knowledge, and also to existing knowledge in the discipline, and be prepared to state this. With this in mind, there has been an attempt to formulate diagnostic criteria for the syndrome\(^2\), and reporters may wish to provide feedback on the use of the diagnostic framework.

Useful information on electrical injury assessment has been given above, and a medico-legal reporter may wish to ensure that the matters outlined in these protocols are given attention.

**Conclusions.**

Not all shocks will come to attention. Given subtle signs for some, e.g. ECG or blood pressure signs, there ought to be erring on the safe side, and basic testing should be done for all but the most minor shocks.

The ultimate question will always be whether a living victim has suffered an electric shock, and whether a death is correctly ascribed to an electric shock. Diagnostic judgment will be required, and the following are factors supporting an electric shock diagnosis:

- Collapse within 15 s of application of current
- Defibrillation shock is quickly successful, given that electric shock VF is readily more reversible than VF of other causes.
- Documented VF – either on AED or during resuscitation attempts
• Was the initial rhythm either asystole or electro-mechanical dissociation? These are not inducible by electric shock. This however does not apply after 20 min from collapse.

• A sudden blood pressure change.

• Marks at potential contact points, especially on chest hands or feet. Nonetheless lack of markings should not deter the diagnosis.

• Documentation of the activity of any implantable device, if present.

The discussion above provides guidance to matters which are important in a thorough report, and reporters may wish to use the criteria and protocols given as ways of constructing comprehensive reports, and evaluating those of others. Limits of current knowledge are emphasised.

This paper is presented with the authors’ common experience of less than adequate documentation of the events by first responders, often simply due to incomplete knowledge of important factors. Further, medical protocols are suggested in response to request, and given a common report that most medical practitioners are not familiar with treating the injury, and also unfamiliar with the long-term effects of electric shock.

It is hoped that the result of presenting this information will be several-fold:

• to provide the knowledgeable medico-legal reporter with comprehensive material on which to make a useful report, often many years later

• to provide information for medical practitioners to gain more familiarity with the injury, both in general and specific emergency circumstances
• to enhance assessment and treatment of the injury, and to point to important follow-up.

The authors look forward to the day when formal records of shocks are established. This will allow better epidemiological documentation of the injury, as well as allowing the injury features and incidences to be firmly established for educational purposes.

**Limitations**

This paper collects together and collates physical and medical aspects of investigating electric shocks. The thoroughness of initial assessment is emphasised. Although, in an attempt to provide uniformity, the authors’ made a strong effort to report on data originating from similar sources, circumstances and outcomes, there still was large variability in the underlying information. Therefore, the underlying variability may constitute a limitation of our report.

**Author Contributions**

Both authors drafted segments of the text, and then in consultation edited and finalised the whole.
REFERENCES


Box 1. Demographic and Identifying Data.

Name, Age, Gender, Address
Height, Weight, BMI
Subjective description – build, habits e.g. nicotine stains
Job position and description
Relation to owner/employer, e.g. employee, contractor, etc.

First Responder name and position
Times of service despatch and arrival – manner called and by whom
Box 2 Physical Circumstances

Current Supply Factors
- AC vs DC injury
- Domestic vs Industrial
- Voltage phase/phase and phase/earth
- Was an RCD present – did it operate
- Was a tool being used – preserve it
- Was a lead being used – preserve it
- Was another device involved – preserve it

Locality factors
- Locality of incident – e.g. at a switchboard, using a tool or lead, activity involved
- Flooring and floor covering
- Domestic – e.g. bathtub, warehouse
- Environment – wet, dry, etc.

Victim factors
- Clothing – state of clothing, e.g. new, breached, sweaty; areas of body accessible either bare or via wet clothing
- Any PPE – was the victim insulated
- Actions of the victim when a shock was received.
- Position of victim relative to involved device/equipment.
- Description of injury marks on victim’s body.
- Estimated time from electric shock to responder or witness arrival.

Inspector Assessment
- Is there any evidence of a fault which might give rise to a shock?
Box 3 “Crossover” Interests

Victim History
- Premorbid medical surgical and trauma history, including any implantable device history.
- Any rehabilitation history
- Premorbid psychiatric history, and any family history
- Premorbid medication and allergies.
- Premorbid alcohol and smoking status.
- Medication prescription history
- Any known use of illegal or recreational drugs.

Special medical responder Items
- Presence of a pacemaker, CPR device
- Presence of an AED
  Of each of these, full details should be obtained – model, serial number, manuals, and especially any logs of rhythm and activation at the time of the shock.

Requests of medical personnel
- Request ECG rhythm charts and assays for alcohol, drugs
BOX 4. Summary of Special items to obtain

AED logs, including ECG rhythm and blood pressure charts and resuscitation shock parameters. These may be erased in fairly short order and should be obtained quickly.

CPR device logs, if any used.

Implantable device details and logs.

Clothing – and impounding of same with chain of custody.

History and photographs – skin marks, metallic objects worn, pose (re-enacted if necessary), devices which may have mediated the shock (impounded as above).

Timeline of accident, and all timestamped logs

Photographs

Requests for assays as indicated.

In case of death, temperature, medical criteria of certifying death, including any history of resuscitation attempts, post mortem testing as required, drug, blood and/or hair analyses as required or indicated. Other body fluid assays as indicated.
BOX 5. Records to obtain – for both medical treater and medical reporter, and statutory inspector.

- Engineering reports will aid the treating medical practitioner
- Installation history
- First Aid at site including AED logs, blood pressure, CPR device logs, will aid both reporters. Full log of first aid and responder and resuscitation. Printouts and electronic downloads.
- Brief description of event, including equipment involved
- Ambulance and transport are of especial interest to medical treatment. Include GCS and behaviour.
- Implantable device logs assist medical treatment, and also assist inspectors
Box 6. Summary of Useful Objects/Reports

AED, CPR device and ECG and blood pressure monitor downloads and printouts
Implanted Device downloads
Clothing – as per Box 4
Tools, leads and objects which were contacted or are sources – as per Box 4
Description of any other equipment involved
Tests and appraisals of these.
Past Medical History reports
BOX 7 SUMMARY OF APPROACH TO ELECTRICAL INJURIES

Parts of the body involved
- Contact points, and how was contact made
- Contact depth of penetration
- Clothing and flooring
- Duration of Contact
- Any Equipment involved

Symptoms
- What was felt and where – heart beat felt, breathing, paralysis, “lock on”
- External Marks
- Any loss of consciousness, or fitting
- Vision, Hearing
- Progress of Symptoms
- Overt Psychological symptoms

Full physical and trauma examination with investigations as described.