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Suicidal Electrocution in Sydney—A 10-Year Case Review*

ABSTRACT: A retrospective study was undertaken of all cases of death due to suicidal electrocution in Sydney, Australia between 1996 and 2005. A total of 25 cases were identified with 20 cases (80%) as a result of direct attachment to an electrical outlet and five cases (20%) as a result of immersion in a body of water with an electrical appliance. Twenty of the 25 individuals were men (mean age = 57 years, range 22–90) and five were women (mean age 67, range 53–88). At least 35% of decedents were either currently working or had worked as electricians. Electrical timers had been used in eight (32%) cases, the fuse blown in one case, but the remaining 16 (64%) bodies were “live” on arrival of witnesses or electricity personnel. This study demonstrates the phenomenon of electrical suicide as a regular occurrence in Sydney. We highlight the need for investigators and emergency workers to remain vigilant upon discovery of electrical suicides, due to the fact that most bodies remain electrically active after death.

KEYWORDS: forensic science, forensic pathology, electrocution, suicide

Suicide continues to be a public health issue worldwide. In 2004, there were 2098 registered deaths from suicide in Australia, making up 1.6% of all deaths for that year (1), similar to the reported proportion of suicides in other industrialized countries (2). Despite the similarity in the overall proportion of suicides, the method in which the suicide is performed differs from country to country. For instance, over 50% of American suicides were firearm related in 2003 (3), compared to only 8% in Australia (1).

Suicidal electrocution is an uncommon but regularly observed method for committing suicide in Australia. Electrical suicide accomplished with a live electrical appliance in a body of water, typically a bathtub, has been described in the literature as early as 1958 (4) and on a number of occasions since then (5,6). While studies have also documented the existence of suicidal electrocution via direct connection to an electrical conduit, these have been single case reports or low-number case studies (7–9).

Reports from both Australia and New Zealand have previously documented comprehensive data regarding electrical deaths from the 1970s to the 1990s (10,11). In the New Zealand study, four suicides were reported, with all four individuals men, using household current (11). The Australian study reported nine suicides from 1976 to 1990, all occurring in male pensioners (10). Additionally, a recent 30-year retrospective study by Byard et al. into all electrical deaths in South Australia observed 28 electrical suicides (12).

While these studies have noted electrical suicide as single case studies or have mentioned them as part of a more global study on electrical death, to our knowledge no comprehensive study has been performed to date that has examined the circumstances and characteristics specifically of electrical suicides. And while a number of studies have documented the mechanism of death and

pathological features of electrical deaths (8,9), there has been no documentation of the pathological changes frequently observed in electrical suicides. The aim of our study was to therefore perform a retrospective study on suicidal electrocutions that have occurred within metropolitan Sydney over the last 10 years, describing common death scene, autopsy, and toxicological findings.

Materials and Methods

This retrospective study investigates the trend of suicide by electrocution in the period from 1996 to 2005 examined at the Department of Forensic Medicine, Glebe, Sydney. A total of 25,675 deaths were investigated at our facility between 1996 and 2005, with definite or probable suicide as the manner of death in 2029 cases. Suicidal electrocution cases were obtained by searching the Department of Forensic Medicine autopsy text database. All cases in this study had a full autopsy, including toxicology and histology, and a detailed death scene investigation by criminalists and electricians had been performed. Both autopsy and lay death investigation reports were examined.

The research protocols had been submitted for approval to the Sydney South West Area Health Service Human Research Ethics Committee and the Office of the New South Wales State Coroner prior to commencement of this study. All work was conducted in accordance with their respective requirements.

Results

There were 25 cases of definite suicidal electrocution (mean 2.5 cases/annum, 1.2% of all completed suicides), and a further three cases of possible suicidal electrocution from 1996 to 2005. The latter three cases were not analyzed further. The age of the victims ranged from 23 to 90. Twelve cases involved individuals over 60 years old, six between the ages of 45 and 60, and seven below the age of 45. Of these 25 cases, the mechanism of death in 20 was via direct connection to an electrical outlet. The remaining five

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*Presented at the 59th Annual Meeting of the American Academy of Forensic Sciences in San Antonio, TX, in February 2007.

Received 4 July 2007; accepted 8 Sept. 2007.

TABLE 1—Summary of all analyzed cases.

Gender	Age (years)	Method	Occupation	Circumstances
Male	33	Outlet	Taxi Driver	Leads taped to chest
Male	81	Outlet	Retired/ex electrical engineer	Leads wrapped around both wrists
Male	30	Outlet	Electrician	Leads taped to wrists and attached to timer
Male	39	Outlet	Sydney Electricity	Leads attached to metal wristwatches on each hand
Male	69	Outlet	Retired	Cutlery in extension cord attached to left hand only
Male	40	Outlet	Electrician	Leads wrapped around both wrists
Male	37	Outlet	Retired	Leads around both hands and plugged into timer
Female	53	Bathtub	Unemployed	Hairdryer in bathtub
Male	39	Outlet	Electrician	Leads around both hands and plugged into timer
Male	58	Outlet	Unemployed, ex cable assigner	Leads around both hands and plugged into timer
Female	53	Bathtub	Retired ex screen printer	Hairdryer in bathtub
Male	63	Outlet	Retired electrician	Leads attached to fingers of both hands
Male	50	Outlet	Delivery driver	One wire attached to left fifth digit, other laid on anterior chest wall
Male	74	Outlet	Retired/ex telecom/lineman	Leads wrapped around both wrists
Female	64	Bathtub	Unemployed/bookkeeper	Curling irons in bathtub
Female	77	Outlet	Retired	Asleep, husband electrically active and put her in embrace in apparent suicide pact
Male	81	Outlet	Retired	Leads around both hands and plugged into timer then wrapped around wife in apparent suicide pact
Male	76	Outlet	Pensioner/ex electrician	Leads around both hands, wired to switch put in hand
Female	88	Bathtub	Retired	Heater in bathtub
Male	90	Bathtub	Unknown	Heating coil in bathtub
Male	22	Outlet	Unemployed, ex demolisher	Leads wrapped around neck and in mouth
Male	45	Outlet	Wood turner	Industrial power box (450 V) with wires attached to both wrists and ground to right leg
Male	76	Outlet	Retired, ex electrician	Leads attached to dinner table legs and then table legs gripped with hands
Male	84	Outlet	Pensioner ex soldier	Leads attached to thumbs bilaterally
Male	47	Outlet	Unemployed	Leads attached to both wrists to timer

cases were the result of immersion of electrical appliances in bodies of water (Table 1).

Only five of the suicides involved women. However, of these five, the mechanism of death was via bathtub electrocution in all but one case. Of the 20 suicides involving men, the mechanism of death was overwhelmingly via electrical mains attachment (19/20, or 95%).

A high number of the decedents were electricians or employed by the electrical industry. Of the 20 decedents who died via electrical outlet, 10 were definitively identified as having worked in the electrical industry. Employment history was not available in five cases, and the other five were employed in either the manual labor or services industry. Of the five individuals who died via bathtub electrocution, three had unknown occupations, while the other two were employed in bookkeeping and artistic occupations.

Physical comorbidity was found in 13 of the electrical outlet cases and three of the five bathtub cases. Many decedents had multiple comorbidities. In the electrical outlet group, eight individuals were found to have more than three comorbidities, two with two comorbidities, and three individuals had a single comorbidity. The most commonly mentioned illnesses are listed in Table 2. All individuals in the bathtub group had at least a single comorbidity (Table 2).

TABLE 2—Medical comorbidities associated with suicide cases.

	Bathtub		Outlet		
	1 (n = 3)	>3 (n = 8)	2 (n = 2)	1 (n = 1)	0 (n = 7)
Cardiovascular	2	6	2	1	—
Neurological	—	6	1	—	—
Musculoskeletal	—	2	—	1	—
Neoplasm	—	6	—	1	—
Other	1	8	1	—	—
Psychological	4	5	—	3	6

Most cases possessed more than one comorbidity.

Mental illness, predominantly depression, was found in 14 (70%) and four (80%) of the outlet and bathtub cases, respectively.

Electrical Outlet Suicides

Analysis of the death scene and autopsy reports of the outlet suicide group revealed 19 cases which occurred in the home setting and one case which occurred in the work setting.

In 17 of the 20 cases, electrical leads were found attached to the extremities. The remaining three cases involved the mouth and neck, left and right lateral borders of the thorax, and a single case which involved the passage of current from one individual to another in what appeared to be a suicide pact (Fig. 1).

Seven of the 20 cases involved electrical timers to terminate the current following death. All remaining 13 bodies were electrically active upon discovery. Of these 13 cases, adequate surge protection was later found to have been present in the house, although in no case did the body cause the surge protection system to interrupt the electrical current. Notes from the deceased warning of potential electrical hazard from touching the body were documented in at least five of the cases. Only one case involved any tampering or disabling of the electrical system.

The presence of deep electrical burn marks at the point of contact of the electrical flex was noted in all cases (Figs. 2A and 3A). Superficial burn marks were also documented on occasion when wires came in contact with other portions of the body (Fig. 3B,C). Internal examination revealed pulmonary edema in 12 (60%) of the cases.

Histologic appearances of the wounds were consistent with low temperature thermal injury, with dermo-epidermal separation, elongation of keratinocytes, and homogenization of dermal collagen noted in all cases where histology was taken. Carbon deposition, and metallic, birifringent material was occasionally observed in superficial layers of skin.

Toxicology was negative in nine (45%) of the cases and positive for ethanol in five (25%) of the cases. The remaining six cases



FIG. 1—Suicide pact in an elderly couple. Timer and wires attached to male with current traveling through both victims. No electrical contact was noted on the female victim apart from that with her electrically active husband.

involved the presence of one or both of morphine and benzodiazepines.

Bathtub Suicides

All deaths in the bathtub suicide group were found at home. Domestic hair care appliances were used in three of the cases, and an industrial sausage heater and space heater (Fig. 4) used in one case each. All bodies were found partially submerged in water, with no external injuries noted in three of the cases. Singed pubic hair and reddish burn marks around the buttocks were found in one case, and one case was too decomposed to analyze further.

No significant internal injury was noted at autopsy in the three cases where no external injury was noted. Histologically, some congestion and homogenization of the dermis consistent with low-grade thermal injury was noted in the case with external thermal injury.

Toxicology screens were positive for sedatives or antidepressants in all four of the nondecomposed cases. Ethanol screen was positive in one case.

Bodies remained electrically active in three of the four nondecomposed cases. Fuses were tripped in the last instance. Of the three cases, where the bodies remained electrically active, only one case involved the use of any tampering of the electrical system. In this case, the circuit breakers were intentionally taped to the “on” position.

Bodies as an Electrical Hazard

Sixteen of the 25 bodies were electrically active on discovery. There were no reported accidental electrocutions or other associated injury upon discovery and disconnection of the body, although one case reported small shocks upon accidentally touching the body, and another reported electrical shocks being felt in metal fixtures throughout a small apartment complex.

Electricity in all cases was disconnected by the individuals who discovered the body. This was the first responder (police or ambulance) in 10 cases, and a friend or family in six cases. The energy

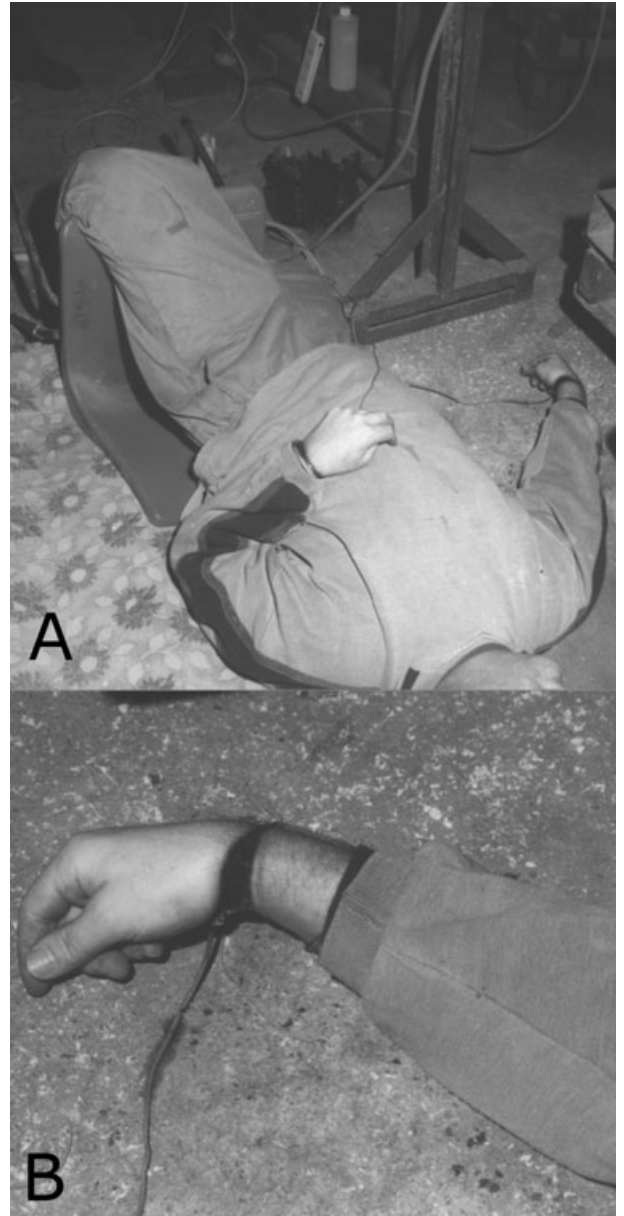


FIG. 2—(A) Electrical outlet suicide in an industrial setting. (B) Deep circumferential burns around points of contact with the electrical lead.

company was called to assess the electrical integrity of the house in only nine cases.

Discussion

We demonstrate a number of different features of electrical suicide not seen before and not as evident with smaller sample groups. Our study shows that there appear to be two separate and distinct groups that commit suicidal electrocution in Australia. One group, comprised mainly of older men with electrical technical backgrounds, commit suicide via direct connection to an electrical outlet. The other group, predominantly women, consists of those who electrocute themselves in a body of water with an electrical appliance.

It is noteworthy that over half of those who died via electrical outlet possess an electrical technical background. The proportion could be higher, given eight of the 20 individuals were of unknown

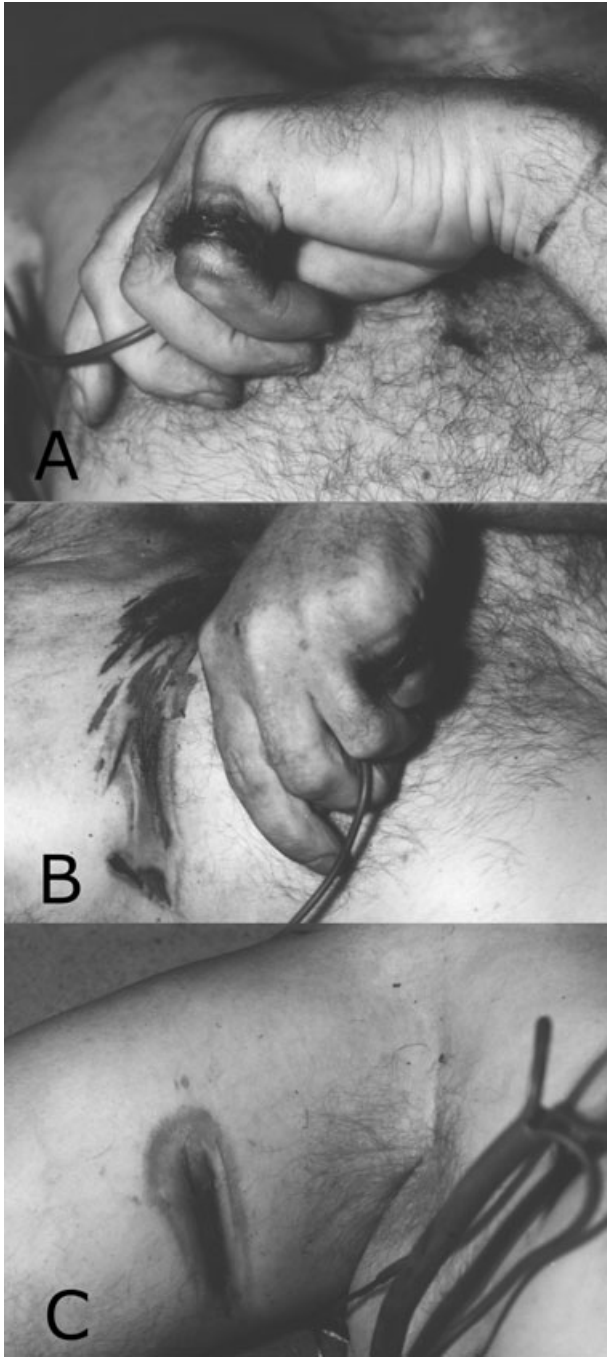


FIG. 3—Electrical outlet suicide. (A) Large area of concentric burning with adjacent ring of erythema around fifth metacarpal. (B) Superficial burning associated with electrically active extremity being in contact with exposed upper trunk. Deep circumferential burn around fifth finger associated with electrical flux contact. (C) 10 mm width linear superficial burn associated with electrical flex contact; 5 mm-wide band of erythema surrounds point of contact.

occupation. While it is not unheard of for electricians to commit suicide in this manner (13), the frequency in which it occurred in this study is surprising.

Twelve of the 25 (48%) electrical suicides occurred in individuals over the age of 60. In Australia between 1996 and 2004, only 16% of all suicides were perpetrated by those over the age of 60 (1). This suggests that suicidal electrocution is a method favored by the old over the young. Given the age distribution of the



FIG. 4—Bathtub suicide. The body, together with a portable fan heater, was found partially submerged in a shallow bath of water.

electrical suicide group, it is not surprising to see a number of them with multiple physical and psychological comorbidities.

The electrical hazard associated with electrical suicides is not insubstantial. Over half of all bodies were electrically active on discovery, resulting in shocks to discoverers on more than one occasion. While no injury was reported as a result of accidentally touching a live body, the case involving suicide of both husband and wife locked in an embrace highlights the potential for current to cross bodies and cause death (Fig. 1).

The mechanism of death in suicidal electrocution is likely ventricular fibrillation as a result of current being conducted through the heart. In Australia, electricity travels at a frequency of 50 Hz, consistent with a frequency known to induce ventricular fibrillation (10). It has also been reported in the literature that a current over 100 milli-Amperes (mA) is necessary to cause ventricular fibrillation (14). The body offers a resistance between 1000 and 2125 ohms (15), which, at a voltage of 220 V, would result in a current of approximately 100–220 mA.

Electrical circuit breakers and fuse boxes operate by deactivating the circuit if the current is too high. In Australia, these activate at currents from 8 to 30 A. The estimated current of 100–220 mA of the electricity running through the body is therefore well under the current needed to trip the circuit. The resistance of the body is therefore sufficient to reduce the amount of current returning to the circuit breaker/fuse to prevent tripping while still providing enough current to cause ventricular fibrillation. And while, as noted in at least one case, the low resistance of water in parallel with the body in a bathtub may allow for sufficient current to return and cause tripping of electrical circuit breakers/fuses, high resistance can

potentially develop between the bath and the earth, resulting in the entire bathtub acting as a resistor. This in turn would cause the mechanisms to remain intact.

Ground fault interrupters (GFI) are widely used as additional electrical safety features in most households across the world. These mechanisms constantly compare the current flow exiting to the appliance to the current returning to the outlet. If sufficient current leaks from the electrical circuit, the difference between supplied and returning current increases, and consequently supply is terminated. In Australia, the leakage threshold is typically 30 mA. (10) However, GFIs are not present in all homes in Australia (10), and it is not known whether or not GFIs were installed in all cases in this study. Even if a GFI were installed in every case, however, its effectiveness would be debatable. The presence of a GFI would be more effective at preventing death in bathtub suicides, where there is greater potential for leakage of current from bathtub to earth. However, in the case of outlet suicides, dry skin can have a resistance as high as 100,000 ohms (14). As a result, current would be less likely to leak from the body and would instead return to the outlet unchanged.

Electrical outlet suicides, therefore, are comparatively more effective than bathtub suicides not because of any fundamental difference in the lethal current, but in their decreased likelihood of triggering safety mechanisms.

No cases of homicide being masked as suicide were reported in any of these cases that we reviewed, but they have been reported in the past (16). As a result, careful forensic investigation to confirm that current flow is possible to have caused death is important. This investigation should include an examination of the death scene by electrical professionals.

Over 30% of outlet suicides used timers to deactivate the body following death. All remaining suicides were electrically live after death. Of those cases which did not use timers, at least five had left a note warning of an electrical hazard. Intentionally or unintentionally, therefore, mechanisms implemented by the individual committing suicide are the most protective against injury for individuals who discover the body.

In conclusion, electrical suicide, especially that involving direct connection to an electrical outlet, is a relatively common and effective method of suicide in Australia. While this study is comprised solely of individuals from the Greater Sydney Area, the ubiquity of electricity allows for these deaths to occur virtually anywhere. The deaths are most likely to occur at home and in

male electricians over the age of 60. As with any death investigation, a proper and thorough scene investigation is paramount. Given the high number of bodies that remain electrically active on discovery, should investigators and rescue personnel be faced with a suicidal electrocution, they should remain vigilant upon removal of the corpse, and all cases should be suitably investigated by an electrical professional.

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