

Illness Fatality in Welding Process; A Case Report

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Abstract

Cardiac arrest is a condition where there is a sudden cessation of cardiac activity, causing a person to become unresponsive to calls/stimuli. If there is no immediate corrective action (Cardiopulmonary Resuscitation and/or defibrillation), this condition will be fatal and can progress to sudden death. A 32-year-old young man who had just worked welding pipes while working at PT.X experienced a cardiac arrest, where there was no breathing and no pulse. It is known that there are several exposures that can be found during the welding process, so it is necessary to carry out an investigation to assess the possible causes of the condition, whether it is due to occupational factors or pre-existing diseases in workers. This case study report focuses on exploring the possible causes of cardiac arrest in this young worker in accordance with his duties as a welder and recommendations for what needs to be done to prevent similar incidents from happening in the future. This case study will also help in creating awareness regarding the need for Daily Check Up monitoring in high-risk workers such as welders.

Keywords: cardiac arrest, fatality, welder

Abstrak

Henti jantung adalah suatu keadaan dimana terjadi penghentian aktivitas jantung secara tiba-tiba sehingga menyebabkan seseorang menjadi tidak responsif terhadap panggilan/rangsangan. Jika tidak segera dilakukan tindakan pertolongan segera (Resusitasi Jantung Paru dan/atau defibrilasi), kondisi ini akan berakibat fatal dan dapat berkembang menjadi kematian mendadak. Seorang pemuda berusia 32 tahun yang baru saja bekerja mengelas pipa saat bekerja di PT.X mengalami serangan henti jantung, dimana tidak ada nafas dan tidak ada denyut nadi. Diketahui terdapat beberapa paparan yang dapat ditemukan selama proses pengelasan, sehingga perlu dilakukan investigasi untuk menilai kemungkinan penyebab kondisi tersebut, apakah karena faktor pekerjaan atau penyakit yang sudah ada pada pekerja.

Laporan studi kasus ini berfokus pada penggalian kemungkinan penyebab serangan jantung pada pekerja muda ini sesuai dengan tugasnya sebagai tukang las dan rekomendasi apa yang perlu dilakukan untuk mencegah kejadian serupa terjadi di masa depan. Studi kasus ini juga akan membantu dalam menciptakan kesadaran tentang perlunya pemantauan pemeriksaan kesehatan rutin harian pada pekerja berisiko tinggi seperti tukang las.

Kata kunci: henti jantung, kematian, tukang las

Introduction

Welding is one of the high-risk work activities that can cause various potential hazards that have an impact on the health of workers, either reversible or irreversible. Welding is one of the techniques for joining metals (metallurgical bonds) by melting some of the parent metal and filler metal with or without pressure, using heat energy. Shielded electrode electric arc welding or better known as SMAW (Shielded Metal Arc Welding) is welding using an electric arc as a heat source to melt metal. Due to the heat from the electric arc, the base metal and the tip of the electrode melt and freeze together.¹

All welding processes produce harmful gases. The gas is invisible to the eye and with/out has an odour. The heat of the flame and arc, and the ultraviolet radiation from the arc, produce gases such as carbon monoxide, carbon dioxide, nitrogen oxides and ozone. The welding process also produces fumes which can form when hot metal vapor cools and condenses into very small particles that remain suspended in the form of steam or gas.^{2,3}

Of the many types of gas or fume that can be produced during the welding process, only a few have acute effect that can cause sudden death, namely CO (Carbon Monoxide) which at high concentrations can cause unconsciousness and death directly. Because CO has a stronger bond with blood haemoglobin than oxygen. Meanwhile, other gases/fumes are more chronic in terms of health effects such as the nervous system or malignant processes.⁴

Cardiac arrest is usually caused by underlying structural heart disease while seventy percent of cardiac arrests are thought to be due to ischemic coronary disease, the leading cause of cardiac arrest. Non-structural cardiac causes include Brugada syndrome, Wolf-Parkinson-White syndrome, and congenital long QT syndrome. There are many non-cardiac etiologists such as intracranial haemorrhage, pulmonary embolism, pneumothorax, primary respiratory arrest, toxic ingestion including drug overdose, electrolyte abnormalities, severe infection (sepsis), hypothermia, or trauma.⁵

The aim of this study was to determine whether the cardiac arrest in this welder came from exposure in the workplace (occupational disease) or not, based on systematically steps of occupational disease assessment.

Case Report

On September 3, 2022, a 32-year-old welder was working on SMAW welding on a 16" pipe in ground level area with his partner facing each other. The operation was carried out in a habitat shelter which measures 190 high, 135 cm wide and 185 cm long and is open on one side for air ventilation. Usually, operation starts from the pre heat spool pipe process up to 120°C, operation from 8 am to 4 pm with a 1-hour rest time at 12 o'clock. After a break the worker continues his work for 1 hour suddenly the welder feels weak and releases all his PPE then backed up and sat back down, the friend who was in front of him saw the victim like that immediately stopped his work and called but did not answer. His friend immediately shouted for the safety man and medics around the location, who immediately came to provide basic life support. An ambulance was called and cardiac-pulmonary resuscitation (CPR) with an AED continuously performed on the job site and in the ambulance, followed by hospital ER for 1 hour. After one hour resuscitation the welder was declared dead at the hospital.

This 32-year-old man before working in the company based on the results of the Medical Check Up (MCU) was declared fit. Pre-employment MCU has been carried out in hospitals that have been recommended by the company. And the results of the daily check-up (DCU) on the day of the incident also show that the worker is in a fit condition to work. He was previously healthy and had never been admitted to the hospital. Of course, information about conditions that take place like that is very rare.

From The data above, raises the clinical question "*Is there any association between workplace exposure and cardiac arrest in welders?*" So, it is necessary to do an assessment and fact-finding in the workplace to find the cause of death because autopsies are not commonly done here.

Method

The assessment, in this case, was carried out based on seven steps in determining occupational disease/accident, namely determining the clinical diagnosis, assessing occupational exposure, evidence-based study supporting the association between exposure and

disease occurrence, the dose of exposure, the presence of individual factors that cause disease, the presence of exposure outside the workplace and the last is the determination of whether the disease is caused by workplace or not.

Result

As initial data, the authors evaluate the medical findings obtained from the hospital’s medical records. Where was found information stating that the welder’s death was due to a sudden cardiac arrest. Furthermore, from the report on physical examination, there were no signs of dark red, red skin colour (cherry red) which is one indicator of carbon monoxide poisoning that comes from high levels of carboxyhaemoglobin in the blood.⁶ Where it is known that this CO gas is formed during the welding process so that it has the potential to cause direct death if its concentration exceeds the threshold limit value (TLV). The results of the patient’s blood examination at the hospital also did not show CO levels in his blood. In addition, signs of electric shock due to power lines of the welding process or bites of venomous animals were also not found on the skin which could also cause direct death in the workplace.

Measurement of exposure

To find the cause of death in this welder, the company formed an investigation team whose task was to find answers whether the death was caused by hazards in the workplace (extrinsic) or from disease factors in the worker itself (intrinsic). So that it can be determined whether it is categorized as a work related caused or not. The team started working by contacting all employees who witnessed the incident and asked them to reconstruct activities at the same place and time during the work process to avoid bias in the results of the work environment measurement that will be carried out next.

Exposures that can be found in the workplace during the welding process include heat, noise (physical), gases and fumes (chemical), venomous animals in the work location (biology), musculoskeletal disorders (ergonomics) and work stress (psychosocial). Among all these exposures, the most likely to cause death directly is from chemical exposure which is carbon monoxide (CO) gas. As in the previous case report

conducted by Antonsson AB et al in 2012, reported fatal cases in welders due to CO gas intoxication during the welding process. So, it is necessary to measure the work environment of these exposures.⁷

Preparation of the working environment is arranged as much as possible to be like the time of the incident, starting from the time of measurement and the condition of the welding habitat/shelter when the welding work was carried out. The actors who do the work are also carried out by all those who have experienced the process except the victim who is carried out by substitute roles, under the supervision of the central company team consisting of management, safety, and medical department. At the start of the pre-heating process, the pipe to be welded to the desired temperature range begins with the welding process. During the welding process, measurements of the working environment are carried out including humidity, temperature, air oxygen levels, CO, NH₃, H₂S and benzene using a calibrated company tool. The measurement results obtained are as follows.

Table 1. Measurement of Workplace

Measurement	Result	Standard TWA ⁸
CO	4-5 ppm	35 ppm
O ₂	20.9%	20,95%
NH ₃	0 ppm	25 ppm
H ₂ S	0 ppm	10 ppm
Benzene	0 ppm	0.1 ppm
Temperature	29.1 °C	23-27°C
Humidity	75%	45-65%

From the measurement results, it is found that only a slightly high working temperature has the potential to cause health problems in the form of dehydration, but we understand this condition will not cause death directly. And the company has also provided drinking water which is close to the work site. The CO levels that we suspect are high are still within the specified normal limits. Even this CO level is lower when compared to CO levels obtained from cigarette smoke released by smokers of 8 ppm.⁹

In addition, the company has provided proper PPE for these workers, where during the investigation it was also found that the workers used complete PPE, one of which was using a special welder mask respirator. Because the CO dose obtained during measurements at the workplace is still within normal limits, the dose

is not sufficient to cause death in this worker. Thus, eliminating the possibility of these workers' deaths due to exposure to CO poisoning.

Personal Factor

From the allo-anamnesis taken on co-workers and the victim's family, it was found that this worker since a week before the incident had complained of feeling pain in the shoulder to the arm area. Where two days earlier, he was also absent for half a day to seek alternative treatment for his illness and buy his own medicine, not from medical practitioners. His co-workers have also advised the victim to seek treatment at a health facility/doctor for definitive treatment of his illness, but he did not do so. Victim also does not report his health conditions to medical officers who are in the field while working, for fear of being given a recommendation to rest/unfit to work so that it will reduce his income.

In addition, workers also used to have a smoking habit which is known to cause cardiac arrest, and a high workload where workers have children from several wives so that this condition becomes his motivation to always be able to work in fulfilling their daily needs. Both factors have been proven in the literature to cause cardiac problem. A meta-analysis study conducted by Aune D et al¹⁰ in 2018, showed that smoking is an established risk factor for cardiovascular disease including coronary heart disease that it causes sudden cardiac death. Also, the latest study in 2022 from Batelaan NM et al¹¹, states that mental stress appears to precipitate syndrome coronaria acute (SCA), presumably by more directly impacting on the cardiac ion channels that control the heart's electrical properties. This may lead to ventricular fibrillation, the arrhythmia that underlies SCA.

From all the process steps that have been carried out above to find possible causes of illness fatality in this worker whether from the workplace or not, it can be concluded that the sudden death of these welding workers is not caused by work factors, even though it occurs while working.

Discussion

The death that occurs anywhere is certainly not something to be desired, especially if it occurs in the

workplace. Because it will lead to various assumptions that develop and even create fear in other workers, whether the environment in which they work is safe and how prepared the company is to handle it. On the company side, it will also be burdened to report incidents such as this whether it is an accident due to work, illness fatality cases related to work or not. Which can affect the good performance of the company. From this case, there is a lot of information that can be learned about the importance of monitoring workers' health, monitoring their work environment, and the readiness of the medical team if they encounter an emergency case like this.

From the results of the investigation, the team also assessed the readiness and evaluation of the medical officers on duty at that time. Where at the time of the incident around the workplace there was already a safety man who also had expertise as a first aider, evacuating and preparing to a safe position for assistance while calling the nearest paramedic. So that after the medical personnel arrived, the aid was immediately taken over and continued with CPR by two rescue paramedics while calling an ambulance. All rescue processes are simultaneous and continuous at the location and the ambulance has even used an AED to help workers until they are transferred to rescuers in the emergency room at the hospital. The hospital team also tried to provide maximum assistance until the worker was declared dead.

As mentioned in the research that cardiac arrest carries a dismal prognosis--most patients do not survive. Because according to American Heart Association data, survival to hospital discharge in patients who experience out-of-hospital cardiac arrest remains low at 10.6%.⁵

Recommendation

However, there are several things that need to be considered by medical personnel in the field, including the need for an active role in inspecting to see workers at work and identify all exposures that can cause health problems for them. So that it can carry out health promotions that directly affect workers to prevent occupational diseases or work accidents. In addition, there is a need for continuous daily health checks up (DCU) on high-risk workers before they start entering the workplace, and not forgetting to ask their health condition if there are any complaints before work. So, they can catch workers who are sick so they can't work

first and can be taken to health facilities for treatment to ensure their health condition. Don't forget to tell their supervisors to always pay attention to their team members in the use of appropriate PPE and report any sick staff to the medical department for follow-up.

Conclusion

Has reported the death of a welder shortly after doing the welding process in the work area of PT.X. From the results of the assessment on all factors that could possibly be the cause of his death, it was found that before dying the worker had suffered from a previous illness of unknown type. The assessment of the exposure found in the workplace, but the dose is not enough to cause his death. While individual factors such as smoking and psychosocial burden in the family are known to have an important role in causing cardiac arrest such as in welders, this is in accordance with many studies. So that the incidence of death in this welder is not caused by exposure in the workplace (not work-related cases).

Conflict of Interest

"The authors declare no conflict of interest".

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Author contribution

AA contributed to conceptualization and methodology. AA and NP contributed to preparing and writing the original draft. NP contributed to supervision. AA contributed to review and editing. All authors have read and approved the final manuscript.

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