Why you should read this article

- To enhance your awareness of the physiological effects and potential complications of exposure to Taser
- To acknowledge recent changes to the assessment and management of people who have been 'tasered'
- To understand the role of nurses in post-Taser assessment and management in custodial and emergency settings

Assessing and managing people exposed to conducted energy device (Taser) discharge

Matthew Peel and Dave Tremlett

Citation
Peel M, Tremlett D (2022) Assessing and managing people exposed to conducted energy device (Taser) discharge. Emergency Nurse. doi: 10.7748/en.2022.e2125

Peer review
This article has been subject to external double-blind peer review and checked for plagiarism using automated software

Correspondence
mattpeel@nhs.net
@nursecustody

Conflict of interest
The authors are members of the Conducted Energy Device Joint Working Group and have co-authored the 'Healthcare Assessment in Police Custody after Conducted Energy Device (CED) Discharge' guideline on which this article is based

Accepted
23 November 2021

Published online
February 2022

Abstract

The use of conducted energy devices – better known under the brand name Taser – by police officers is subject to scrutiny. Consequently, the clinical assessment and management of people who have been exposed to Taser discharge is also subject to scrutiny. In 2021 the Conducted Energy Device Joint Working Group published a new guideline on assessment in police custody after Taser discharge. The guideline enables any appropriately trained and competent healthcare professional, including nurses, to undertake post-Taser assessments and determine the person's fitness to be detained in police custody. This would be done in the first instance by nurses working in police custody suites, but emergency department (ED) nurses may also be involved, as people who have been 'tasered' may need referral to the ED. This article explains how Tasers work, their physiological effects and potential complications, and the required approaches to clinical assessment and management as outlined in the new guideline.

Author details

Matthew Peel, advanced clinical practitioner, Leeds Community Healthcare NHS Trust, Leeds, England; Dave Tremlett, lead nurse, Partnering Health Limited, Whiteley, England

Keywords

advanced practice, clinical guidelines, clinical skills, forensic nurses, forensic nursing, emergency care, emergency services, nursing care, nursing roles, practice development, professional

Introduction

Taser – an acronym for Thomas A. Swift's Electric Rifle – is a brand name for conducted energy devices. Developed in the US in the 1960s, conducted energy devices were introduced in the UK in the early 2000s and have been used increasingly by UK police forces since then (Childers et al 2020). Conducted energy devices are designed to temporarily incapacitate a person through the use of an electrical current that interferes with the neuromuscular system and produces severe pain (Independent Office for Police Conduct (IOPC) 2021).

Anyone taken into police custody who has been exposed to Taser discharge must be assessed by a healthcare professional (Conducted Energy Device (CED) Joint Working Group 2021). Before 2021, only doctors could conduct post-Taser assessments and determine the person's fitness to be detained in police custody (Childers et al 2020). Nurses could only make interim decisions and refer people to hospital (Childers et al 2020), which resulted in unnecessary referrals to the emergency department (ED) (Stevenson and Drummond-Smith 2020).

The CED Joint Working Group (2021) recently published a new guideline, Healthcare Assessment in Police Custody after Conducted Energy Device (CED) Discharge, which supports any appropriately trained and competent healthcare professional to undertake post-Taser assessments and determine the person's fitness to be detained in police custody. Since the publication of this guideline, this can be done by nurses. Nurses working in police custody suites are familiar with the assessment and management

of people with a range of undiagnosed and undifferentiated conditions, including mental health crises and alcohol or drug withdrawal, so they are well placed to undertake post-Taser assessments and subsequent management. Since people who have been 'tasered' may need referral to the ED, ED nurses may also be involved in post-Taser assessments and management.

This article explains how a Taser works, its physiological effects and potential complications and the required approaches to clinical assessment and management as outlined in the new guideline (CED Joint Working Group 2021).

Taser use in the UK

In the UK, police officers are allowed to use a Taser in pursuit of a lawful objective if they consider the use reasonable, proportionate and necessary (IOPC 2021). Only specially trained police officers are allowed to use a Taser (College of Policing 2021).

In 2020, according to figures provided by the different police forces (Home Office 2020a, Police Service of Northern Ireland 2020, Police Scotland 2021), police officers deployed a Taser 32,540 times but only discharged it 5,045 times, which equates to 16% of its deployment. Recent additional funding to increase the number of police officers trained in using a Taser (Home Office 2019) means their use is likely to increase.

Taser use is controversial and subject to scrutiny (McGuinness 2016, IOPC 2021) – the controversy around Taser use is beyond the scope of this article. However, Taser use in the UK has been found to be associated with fewer injuries, as a proportion of use, than other police tactics such as physical contact, baton strikes, irritant spray or police dogs (Stevenson and Drummond-Smith 2020). Since the devices were introduced, there have been 17 recorded deaths involving a Taser in England and Wales and no recorded deaths in Scotland or Northern Ireland (CED Joint Working Group 2021).

Devices

There are three devices approved for police use in the UK, the Taser X26, X2 and 7. Table 1 summarises their characteristics. Depending on the device, one or two cartridges can be loaded. Each cartridge contains two probes connected to the device by insulated conductive wires (Stopyra et al 2017). The devices are battery operated and, when deployed successfully, deliver a rapid series of short electrical pulses via the wires and probes.

Taser X26

The Taser X26, introduced in 2005/2006, carries a single cartridge and fires 'standard' probes. Keeping the trigger pressed will continue to discharge the device (that is, send a series of electrical pulses) until the battery is drained (Home Office 2016).

Taser X2

The Taser X2, introduced in 2017, fires 'SP' probes and carries two cartridges - fired separately - which reduces the need for reloading. It is fitted with an 'auto-shutdown performance magazine' safety feature, which limits the overall time during which electrical pulses are sent (discharge) to five seconds. However, further discharge is possible by releasing the trigger and pressing it again (Home Office 2016).

Taser 7

The Taser 7, introduced in 2020, also carries two cartridges and is fitted with the auto-shutdown safety feature (Scientific Advisory Committee on the Medical Implications of Less-Lethal Weapons (SACMILL) 2020). It fires 'breakaway' probes (Home Office 2020b, SACMILL 2020) and diverges significantly from earlier models in several aspects:

- Each pair of probes delivers 22 pulses per second. When all four probes make contact, the person will receive double the amount of electrical pulses. This is because the Taser 7, unlike the Taser X2, continues to send electrical pulses down the wires/probe of the first cartridge after it has fired its second cartridge.
- The wire uncoils from the probe rather than from the cartridge. The probe is designed to separate from the wire when the wire reaches its maximum length (in which case the Taser would not work). This is a safety feature intended to prevent the probe from recoiling, behaving unpredictably and accidentally injuring someone else. However, this also means that the probe may travel further, which increases the risk of probe injuries to the targeted person (SACMILL 2020).
- The probe is designed so that its body breaks away from its bumper and barb when it makes contact with a person – hence the term 'breakaway probe'.
- The technique for removing probes is different than for the two earlier models (CED Joint Working Group 2021) and is discussed later in the article.

Key points

- Police officers in the UK can lawfully use a Taser if they have been trained and if its use is reasonable and proportionate
- Anyone taken into police custody who has been exposed to Taser discharge must be assessed by a healthcare professional
- Primary complications of Taser use include arrhythmia, seizure, stroke, miscarriage and rhabdomyolysis, but reported cases are extremely rare
- People who have been 'tasered' need probes removed and potentially treatment for injuries caused by probes or falls
- Nurses have the authority to make decisions regarding a person's fitness to be detained in police custody after exposure to Taser discharge

Modes of use

Taser use typically aims to produce neuromuscular incapacitation by involuntary stimulation of sensory and motor nerves, which is achieved either through the 'probe' mode or the 'three-point contact' mode. Alternatively, the 'drive-stun' mode enables use of a Taser to produce pain (Kroll et al 2019).

Probe mode

The probes are projected at a speed of 160 feet per second (Childers et al 2020). To produce neuromuscular incapacitation, two probes from the same device must make contact with the person – by attaching to their clothing and/or penetrating their skin – which creates an electrical circuit. The two probes must be sufficiently far apart, ideally by at least 23cm, with one probe above and one below the beltline (McGuinness 2016, SACMILL 2016). This spread is required so that sufficient muscle mass is involved. If only a single probe makes contact with the person, or if two probes make contact with the person but are not sufficiently spread, the Taser may not work or may be less effective (SACMILL 2016).

Drive-stun mode

In drive-stun mode the front of the Taser, which contains two electrodes, is driven into the person's clothing or exposed skin, which causes localised pain but not neuromuscular incapacitation. Although it may seem more aggressive, drive-stun mode is less harmful than probe mode, since it can only cause minor localised injuries (CED Joint Working Group 2021).

Three-point contact mode

If the probe mode has been unsuccessful, the police officer can swap to the three-point contact mode as a backup. With the probe or probes still attached to the person, the police officer uses the Taser in drive-stun mode (see above) which creates the probe spread required to produce neuromuscular incapacitation, as long as the new contact is not too close to the previous probe(s) (SACMILL 2016).

Physiological effects

Box 1 lists the physiological effects of neuromuscular incapacitation produced by Taser discharge.

Studies have explored the physiological effects of Taser in controlled conditions using healthy participants typically exposed to a single five-second discharge. Consequently, their findings do not reflect the real world where people may be exposed to repeated discharge or discharge lasting longer than five seconds, may be under the influence of alcohol and/or drugs, may be experiencing a mental health crisis and/or may be physically exhausted from running, struggling or fighting.

Table 1. Taser X26, X2 and 7: summary of characteristics

Model	Probe	Probe size (barb size)	Number of cartridges	Range	Number of electrical pulses per second	Duration of each electrical pulse
Taser X26 	Standard probe 	3.8cm (1.0cm barb)	One	6.4m	19	110 microseconds
Taser X2 	SP probe 	3.4cm (1.1cm barb)	Two	7.6m	19	80 microseconds
Taser 7 	Breakaway probe 	2.2cm (1.1cm barb)	Two	7.6m	22	45 microseconds

Conducted Energy Device Joint Working Group (2021) Reproduced with permission from the UK Association of Forensic Nurses and Paramedics

Cardiovascular system

Levine et al (2007) noted an increased heart rate, and Vilke et al (2007) noted a decreased heart rate, in people exposed to Taser discharge. Sloane et al (2008) found that a single five-second Taser discharge was not followed by raised troponin levels after six hours – raised troponin levels are a marker of myocardial injury (Gresslien and Agewall 2016). However, Levine et al (2007), who looked at participants' heart rhythm on electrocardiogram (ECG), noted QT interval changes immediately after Taser discharge, although they could not determine their significance. Changes in QT interval can cause arrythmia. If the QT interval is prolonged there is a risk of ventricular arrhythmia which can result in sudden collapse or cardiac arrest (Schwartz and Woosley 2016).

A review of three cases of possible vascular thromboembolic events after exposure to Taser discharge concluded that coagulation or the development of a thrombus are not complications of Taser discharge (Kroll et al 2020). As mentioned above, there is a small risk of Taser discharge causing immediate arrhythmia, but since electricity does not build up in the person's body there is no risk of delayed arrhythmia (Childers et al 2020). Theoretically the risk of arrhythmia is increased in people with underlying heart disease and/or implanted devices such as pacemakers (Roberts and Vilke 2016). The effects of repeated and/or prolonged Taser discharge on the cardiovascular system are unclear (Roberts and Vilke 2016).

Respiratory system

Vilke et al (2007) noted an increased respiratory rate and volume one minute after exposure to Taser discharge, which resolved within 10 minutes, and found no evidence of hypoxia. These findings are supported by subsequent studies (Roberts and Vilke 2016).

Metabolism

Vilke et al (2007) noted a slight increase in lactate one minute after exposure to Taser discharge, causing brief and clinically insignificant pH changes.

Box 1. Physiological effects of neuromuscular incapacitation produced by Taser discharge

People exposed to Taser discharge can experience any of the following:

- Inability to control posture, which puts the person at risk of uncontrolled and unprotected falls
- Muscle contraction, spasm or stiffening, giving the appearance of convulsion – this may affect the whole body or may be isolated to a limb depending on where the probes have made contact
- Leg rigidity – the leg may look like it is 'kicking out'
- Severe pain
- Involuntarily calling out or making noises
- Inability to respond to verbal commands
- Being 'frozen on the spot'

(Adapted from Conducted Energy Device Joint Working Group 2021)

Primary and secondary complications

A US-based prospective, multicentre, observational study of 1,201 real-world Taser uses found that almost all people (*n*=1198) had sustained either mild injuries or no injuries (Bozeman et al 2009). A retrospective UK study of 60,000 real-world incidents of use of force by the police found that, of 5,444 Taser uses, 485 (9%) had resulted in injury (Stevenson and Drummond-Smith 2020).

Box 2 lists potential primary and secondary complications of Taser discharge. Primary complications are those potentially caused by electric current flow (CED Joint Working Group 2021), although Stevenson and Drummond-Smith (2020) cautioned that correlation does not imply causation. Secondary complications include probe injuries and injuries from falls (CED Joint Working Group 2021).

As mentioned above, there is a small risk of Taser discharge causing immediate arrhythmia. There has been one report of a tonic-clonic

Box 2. Potential primary and secondary complications of Taser discharge

Primary complications:

- Arrhythmia
- Seizure
- Stroke
- Miscarriage
- Rhabdomyolysis

Secondary complications:

- Probe site burns
- Probe injuries:
  - The probe has penetrated the skull (potentially causing skull fracture), eyes, throat, chest wall (potentially causing pneumothorax) or testes
  - Any part of the probe remains within the body after probe removal
- Injuries from falls:
  - Head injuries
  - Facial fractures
  - Traumatic brain injuries
  - Spinal fractures

(Adapted from Conducted Energy Device Joint Working Group 2021)

seizure in a 30-year-old man with no previous history of seizures after a Taser discharge with a probe in the back of the head (Bui et al 2009) and one report of a 32-year-old man who had an ischaemic stroke following a Taser discharge with a probe in the forehead (Bell et al 2014).

There has been one report of miscarriage in an 8-to-12-week pregnant woman who had been exposed to Taser discharge. The report noted that the woman miscarried one week after exposure to Taser discharge and was known to use heroin (Mehl 1992).

There have been two reports of rhabdomyolysis, a condition that occurs when damaged muscle tissue releases its proteins and electrolytes into the blood, which can damage the heart and/or kidneys and cause permanent disability or death. The first case involved a 51-year-old man – who had cut his wrists and throat in a suicide attempt and physically resisted police officers and healthcare professionals – who developed rhabdomyolysis 12 hours after surgery (Gross et al 2013). The second involved a 31-year-old man with a history of schizophrenia who had been exposed to three five-second Taser discharges and required restraint and sedation in hospital (Gleason and Ahmad 2015).

Most probes hit the torso and therefore most probe injuries are sustained on this part of the body (Lewis and Lewis 2016). Direct probe injuries to bone are rare because the probes are stopped by the skin (Manhas et al 2021). There have been cases where probes have embedded in the skull, eyes or testes (Manhas et al 2021).

Clinical assessment

Tasers are normally used with people who are aggressive and/or uncooperative and who may remain so when undergoing clinical assessment, which potentially makes the assessment challenging and increases the risk of diagnostic error (Mamede et al 2017, IOPC 2021).

The person's clinical condition will determine the assessment approach. People who are in a critical condition will require assessment using the airway, breathing, circulation, disability, exposure (ABCDE) approach (Resuscitation Council UK 2021) and resuscitative measures as needed.

People who appear clinically well and do not have any immediately obvious injuries will require the typical sequence of history taking followed by examination. To assist in identifying potential injuries it is important to obtain a collateral history – that is, the circumstances leading to Taser discharge, the incident itself and its aftermath – from the police. If police officers have recorded the incident with body-worn cameras, viewing the recordings is useful to observe what happened when the person was exposed to Taser discharge; for example, an awkward fall or a fall from a height (CED Joint Working Group 2021). Box 3 details the elements of the clinical assessment of people exposed to Taser discharge who appear relatively well.

Given the scrutiny of Taser use, assessments must be thoroughly conducted and documented. The UK Association of Forensic Nurses and Paramedics and the Faculty of Forensic and Legal Medicine have dedicated online information hubs – see under 'Further resources' – where additional information can be found, including an assessment form for forensic clinicians, guidance for police custody staff, guidance for ED clinicians, a patient factsheet for people exposed to a Taser discharge and videos on probe removal.

Box 3. Clinical assessment of people exposed to Taser discharge who appear relatively well

Collateral history
- Person's behaviour leading to the use of Taser
- Potential mental health crisis and/or intoxication with drugs and/or alcohol
- Details of the number and duration of Taser discharges
- Effects on the person
- Details of injuries and/or falls
- Location of probes and whether they are still in place
- Use of other force

Past history
- Medical history
- Psychiatric history, including self-harm and suicide attempts
- Presence of a learning disability and/or autism
- Medicines history
- Allergies
- Social history, including alcohol and/or drug use – specifically recent use
- Family history

Examination
- General survey
- Mental state
- Injury assessment and documentation
- Respiratory system function
- Cardiovascular system function
- Abdominal injuries
- Neurological system function
- Musculoskeletal system function
- Genital injuries – if indicated

(Adapted from Conducted Energy Device Joint Working Group 2021)

Management

Hospital referral

Fit and well people who are asymptomatic and in whom the initial assessment has detected no significant injuries do not require assessment in the ED, routine ECG or routine blood tests (Childers et al 2020). According to Stevenson and Drummond-Smith (2020) less than 5% of people exposed to Taser discharge are admitted to hospital from an ED. However, partly because of the scrutiny of Taser use, nurses working in custodial settings should have a relatively low threshold for referral to hospital. Police custody is not a safe environment for anyone who is acutely unwell and, as Wyatt et al (2011) pointed out, custody is not a 'mini-hospital'.

The CED Joint Working Group (2021) guideline contains 'red flags' indicating that hospital referral is required and 'amber flags' indicating that hospital referral may be required. This may or may not be referral to the ED – pregnant women for example may be referred directly to a maternity centre. Table 2 details the red and amber flags contained in the CED Joint Working Group (2021) guideline.

Probe removal

Probes should be removed as soon as possible to prevent further discomfort and harm and reduce the risk of infection. If they are not embedded in a sensitive area (see Table 2), they can be removed by a healthcare professional in the setting where the initial assessment took place. If they are embedded in a sensitive area (see Table 2) the person must be referred to the ED.

It is recommended that the healthcare professional removing the probe wears gloves (CED Joint Working Group 2021). They should also start by warning the person that they will feel some discomfort or slight pain. Before the probe is removed – or before the person is taken to the ED for probe removal – the wires need to be cut. The device's range varies from 6.4m to 7.6m so the wires are long and present a trip and injury hazard. Each wire should be cut approximately 5cm from the probe with scissors.

When removing a probe, the healthcare professional should support and slightly stretch the skin around it and follow the subsequent procedures. The Taser X26 and Taser X2 'standard' and 'SP' probes are removed by grasping the probe's body with one's fingers – typically using the thumb and index of the dominant hand – and applying rapid and firm traction (CED Joint Working Group 2021).

The Taser 7 'breakaway' probe is removed using a specifically designed safety clip that features on Taser 7 cartridges. Police forces are required to make a cartridge safety clip available to healthcare professionals in custody suites and hospitals (College of Policing 2021). If a cartridge safety clip is not available, a Taser 7 probe can be removed using forceps or a needle holder (CED Joint Working Group 2021). As explained earlier, the Taser 7 'breakaway' probe is designed so that the body breaks away from the bumper and barb on contact with the person. If this happens – which is not always the case – only the probe bumper and barb are left to be removed.

Figure 1 shows Taser 7 probe removal using a cartridge safety clip. Figure 2 shows Taser 7 probe removal using a needle holder. In Figure 2, the wire has been cut approximately 5cm from the probe and the probe body is still attached to the bumper and barb.

Probe removal typically produces a small puncture wound which may cause slight bleeding depending on the area. The area will need to be cleaned with water and dressed with a simple adhesive dressing. If the wound is bleeding, pressure should

FURTHER RESOURCES

UK Association of Forensic Nurses and Paramedics – Conducted energy device information hub
ukafn.org/ced

Faculty of Forensic and Legal Medicine – Conducted energy device information hub
fflm.ac.uk/CEDHub/

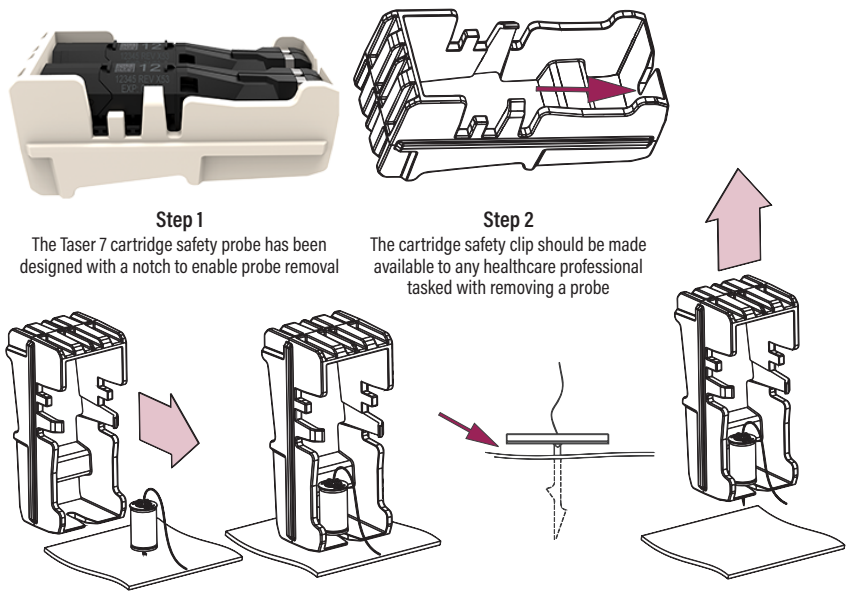
Table 2. Red and amber flags indicating that hospital referral is or may be required

Red flags (hospital referral is required)	Amber flags (hospital referral may be required)
People exposed to Taser discharge must be referred to hospital if they present with any of the following: » Suspected acute behavioural disturbance » If the probe has penetrated, and remains embedded in, a sensitive area such as: — Face — Neck — Genitals — Spine — Hands — Feet — Joints — Arteries and large veins » Implanted devices such as pacemaker, implantable cardioverter defibrillator or vagus nerve stimulator » Pregnancy » Chest pain, palpitations and/or irregular pulse » Any condition in which there is a threat to the airway, breathing or circulation » People with a head injury who are intoxicated or meet the criteria for hospital referral set by the National Institute for Health and Care Excellence (2019) clinical guideline on head injuries » People who appear intoxicated and incapable – that is, who cannot walk and talk	People exposed to Taser discharge may need to be referred to hospital if they present with any of the following: » Significant burn at the probe site » If the probe has penetrated, but is no longer embedded in, a sensitive area such as: — Face — Neck — Genitals — Spine — Hands — Feet — Joints — Arteries and large veins » Previous spinal and neurosurgery » Any injury requiring further assessment or management not available outside of hospital Children and young people aged below 18 years may need to be referred to hospital even if they do not present with any of the above

(Adapted from Conducted Energy Device Joint Working Group 2021)

be applied until bleeding stops. The Taser's electrical pulses sterilise the probes by electroporation (Kroll et al 2016) and there is no evidence that probes present a risk of infection that warrants routine antibiotic prophylaxis (SACMILL 2016). However, antibiotic prophylaxis may be needed if the probe is embedded in a particularly sensitive area or if the person has diabetes mellitus or is immunocompromised (Kroll et al 2016). Removed probes should be inspected to ensure they are intact. If there is suspicion that any part of the probe remains within the body, an X-ray may be required.

Figure 1. Taser 7 probe removal using a cartridge safety clip



(Reproduced with permission and adapted from the UK Association of Forensic Nurses and Paramedics)

Figure 2. Taser 7 probe removal using a needle holder

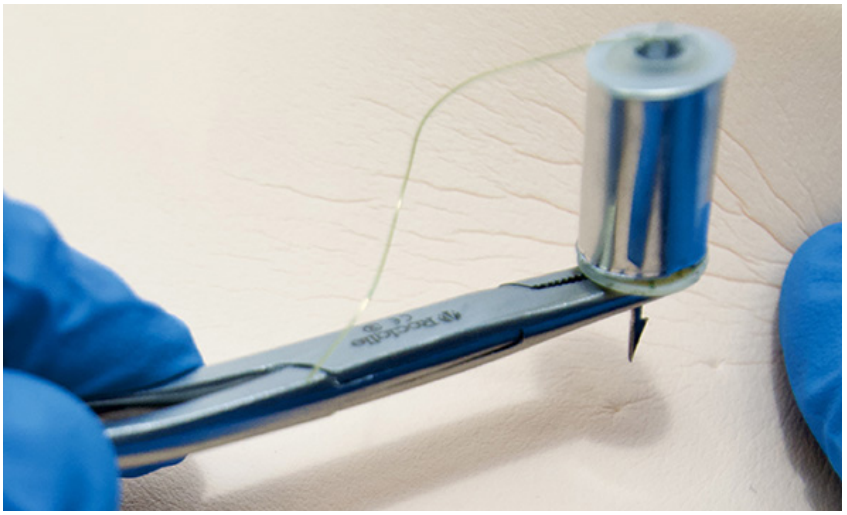


Image courtesy of Matthew Peel

Once removed, probes should be treated as a biohazard sharp. Ideally, police officers should retain probes as evidence. This is done using a 'post-use pack', which police forces are required to provide to the healthcare professional removing the probe (College of Policing 2021). However, post-use packs are not always available, in which case the probes are not retained but disposed of in a sharps bin.

Care in the emergency department

Most people referred to the ED following exposure to Taser discharge are likely to be detained by police officers. They are entitled to the same standard of care as any other patient (Royal College of Emergency Medicine (RCEM) 2016). People who receive care in the ED and are then discharged as fit for detention in a police custody suite need to be given a discharge summary or similar (Royal College of Psychiatrists and Faculty of Forensic and Legal Medicine 2020). ED nurses will need to share appropriate and relevant information with the custody healthcare team in a secure manner to ensure patient safety and continuity of care (Peel 2015, RCEM 2016, Royal College of Nursing 2017).

Conclusion

The guideline published by the CED Joint Working Group sets new standards for the assessment and management, by healthcare professionals, of people who have been exposed to Taser discharge. The guideline enables nurses working in police custody suites or EDs to conduct post-Taser assessments, remove probes and make decisions regarding the person's fitness to be detained and their need for further assessment and treatment. Post-Taser assessment and management can be compounded by a person's unwillingness to cooperate or aggressive behaviour but should receive the same standard of care as any other patient.

To provide a high standard of care, it is important that nurses understand how a Taser works and its physiological effects and potential complications, in particular cardiovascular effects and secondary injuries caused by probes or falls.

References

Bell N, Moon M, Dross P (2014) Cerebrovascular accident (CVA) in association with a Taser-induced electrical injury. Emergency Radiology. 21, 2, 211-213. doi: 10.1007/s10140-013-1180-2

Bozeman WP, Hauda II WE, Heck JJ et al (2009) Safety and injury profile of conducted electrical weapons used by law enforcement officers against criminal suspects. Annals of Emergency Medicine. 53, 4, 480-489. doi: 10.1016/j.annemergmed.2008.11.021

Bui ET, Sourkes M, Wennberg R (2009) Generalized tonic-clonic seizure after a taser shot to the head. Canadian Medical Association Journal. 180, 6, 625-626. doi: 10.1503/cmaj.081364

Childers R, Chan T, Vilke G (2020) TASER conducted electrical weapons. In Stark MM (Eds) Clinical Forensic Medicine: A Physician's Guide. Fourth edition. London, Springer, 279-312.

College of Policing (2021) Armed Policing: Conducted Energy Devices (TASER). www.app.college.police.uk/app-content/armed-policing/conducted-energy-devices-taser/ (Last accessed: 7 January 2022.)

Conducted Energy Device Joint Working Group (2021) Healthcare Assessment in Police Custody after Conducted Energy Device (CED) Discharge. www.ukafn.org/wp-content/uploads/2021/08/Healthcare-assessment-in-police-custody-after-conducted-energy-device-CED-discharge.pdf (Last accessed: 7 January 2022.)

Gleason JB, Ahmad I (2015) TASER® Electronic control device-induced rhabdomyolysis and renal failure: a case report. Journal of Clinical and Diagnostic Research. 9, 10, HD01-02. doi: 10.7860/JCDR/2015/15465.6608

Gresslien T, Agewall S (2016) Troponin and exercise. International Journal of Cardiology. 221, 609-621. doi: 10.1016/j.ijcard.2016.06.243

Gross ER, Porterieko J, Joseph DA (2013) Rhabdomyolysis and oliguric renal failure after use of TASER®: is it really safe? The American Surgeon. 79, 12, 337-339. doi: 10.1177/000313481307901201

Home Office (2016) CED Replacement Project: Assessment of TASER X2 Against the Police Operational Requirements. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/676911/CAST_Assessment_of_the_Taser_X2_against.... pdf (Last accessed: 7 January 2022.)

Home Office (2019) Home Office Announces £10 Million for TASER Uplift. www.gov.uk/government/news/home-office-announces-10-million-for-taser-uplift (Last accessed: 7 January 2022.)

Home Office (2020a) Police Use of Force Statistics, England and Wales: April 2019 to March 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945435/police-use-of-force-apr2019-mar2020-hosb3720.pdf (Last accessed: 7 January 2022.)

Home Office (2020b) Priti Patel Approves New Taser Model to Protect Officers and the Public. www.gov.uk/government/news/priti-patel-approves-new-taser-model-to-protect-officers-and-the-public (Last accessed: 7 January 2022.)

Independent Office for Police Conduct (2021) Review of IOPC Cases Involving the Use of Taser 2015-2020. www.policeconduct.gov.uk/sites/default/files/Documents/research-learning/IOPC_Taser_review_2021.pdf (Last accessed: 7 January 2022.)

Kroll MW, Ritter MB, Guilbault RA et al (2016) Infection risk from conducted electrical weapon probes: what do we know? Journal of Forensic Sciences. 61, 6, 1556-1562. doi: 10.1111/1556-4029.13148

Kroll MW, Brave MA, Pratt HMO et al (2019) Benefits, risks, and myths of TASER® handheld electrical weapons. Human Factors and Mechanical Engineering for Defense and Safety. 3, 1, 1-3. doi: 10.1007/s41314-019-0021-9

Kroll MW, Witte KK, Kunz SN et al (2020) Electrical weapons, hematocytes, and ischemic cardiovascular accidents. Journal of Forensic and Legal Medicine. 73, 101990. doi: 10.1016/j.jflm.2020.101990

Levine SD, Sloane CM, Chan TC et al (2007) Cardiac monitoring of human subjects exposed to the taser. Journal of Emergency Medicine. 33, 2, 113-117. doi: 10.1016/j.jemermed.2007.02.018

Lewis MC, Lewis DE (2016) Frontal sinus TASER dart injury. Journal of Emergency Medicine. 50, 3, 490-492. doi: 10.1016/j.jemermed.2015.09.024

Mamede S, Van Gog T, Schuit SC et al (2017) Why patients' disruptive behaviours impair diagnostic reasoning: a randomised experiment. BMJ Quality and Safety. 26, 1, 13-18. doi: 10.1136/bmjqs-2015-005065

Manhas NS, Stahl D, Schellenberg M et al (2021) Non-lethal weapon: injury patterns and imaging correlates for firearm alternatives. Clinical Imaging. 79, 165-172. doi: 10.1016/j.clinimag.2021.03.007

McGuinness T (2016) Taser Use in England and Wales. House of Commons Library. Briefing Paper Number 7701, 12 September 2016. researchbriefings.files.parliament.uk/documents/CBP-7701/CBP-7701.pdf (Last accessed: 7 January 2022.)

Mehl LE (1992) Electrical injury from Tasering and miscarriage. Acta Obstetricia et Gynecologica Scandinavica. 71, 2, 118-123. doi: 10.3109/00016349209007967

National Institute for Health and Care Excellence (2019) Head Injury: Assessment and Early Management. Clinical Guideline No. 176. NICE, London.

Peel M (2015) Assessing fitness to detain in police custody. Nursing Standard. 30, 11, 43-49. doi: 10.7748/ns.30.11.43.s46

Police Scotland (2021) 21-0825 – Armed Policing – Taser Use – 2017 – 2020. www.scotland.police.uk/access-to-information/freedom-of-information/disclosure-log/2021/april/21-0825-armed-policing-taser-use-2017-2020/ (Last accessed: 7 January 2022.)

Police Service of Northern Ireland (2020) Use of Force Statistics: 1st April 2019 to 31st March 2020. www.psni.police.uk/globalassets/inside-the-psni/our-statistics/statistics-on-police-use-of-force/2020/march/use-of-force-1-apr-2019---31-mar-2020-official-public.pdf (Last accessed: 7 January 2022.)

Resuscitation Council UK (2021) The ABCDE Approach. www.resus.org.uk/library/abcde-approach (Last accessed: 7 January 2022.)

Roberts EE, Vilke GM (2016) Restraint techniques, injuries, and death: conducted energy devices. In Payne-James J, Byard RW (Eds) Encyclopedia of Forensic and Legal Medicine. Second edition. Elsevier, Oxford, 118-126.

Royal College of Emergency Medicine (2016) Best Practice Guideline: Emergency Department Patients in Police Custody. https://rcem.ac.uk/wp-content/uploads/2021/10/ED_Patients_in_Police_Custody_revised_June2016.pdf (Last accessed: 7 January 2022.)

Royal College of Nursing (2017) Supporting Nursing Staff Caring for Patients from Places of Detention. RCN, London.

Royal College of Psychiatrists and Faculty of Forensic and Legal Medicine (2020) Detainees with Substance Use Disorders in Police Custody: Guidelines for Clinical Management (Fifth Edition). https://fflm.ac.uk/wp-content/uploads/2020/12/college-report-cr227.pdf (Last accessed: 7 January 2022.)

Schwartz PJ, Woosley RL (2016) Predicting the unpredictable: drug-induced QT prolongation and torsades de pointes. Journal of the American College of Cardiology. 67, 13, 1639-1650. doi: 10.1016/j.jacc.2015.12.063

Scientific Advisory Committee on the Medical Implications of Less-Lethal Weapons (2016) Statement on the Medical Implications of Use of the TASER X2 Conducted Energy Device System. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/595242/Medical_Statement_on_the_TASER_X2_system.pdf (Last accessed: 7 January 2022.)

Scientific Advisory Committee on the Medical Implications of Less-Lethal Weapons (2020) Statement on the Medical Implications of the TASER 7™ Conducted Energy Device System. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911328/20200716_SACMILL_TASER_7_Medical_Statement_Final_HoC_Library.pdf (Last accessed: 7 January 2022.)

Sloane CM, Chan TC, Levine SD et al (2008) Serum troponin I measurement of subjects exposed to the Taser X-26. Journal of Emergency Medicine. 35, 1, 29-32. doi: 10.1016/j.jemermed.2007.08.073

Stevenson R, Drummond-Smith I (2020) Medical implications of conducted energy devices in law enforcement. Journal of Forensic and Legal Medicine. 73, 101948. doi: 10.1016/j.jflm.2020.101948

Stopyra JP, Winslow JE, Fitzgerald DM et al (2017) Intracardiac electrocardiographic assessment of precordial TASER shocks in human subjects: a pilot study. Journal of Forensic and Legal Medicine. 52, 70-74. doi: 10.1016/j.jflm.2017.08.004

Vilke GM, Sloane CM, Bouton KD et al (2007) Physiological effects of a conducted electrical weapon on human subjects. Annals of Emergency Medicine. 50, 5, 569-575. doi: 10.1016/j.annemergmed.2007.05.004

Wyatt J, Squires T, Norfolk G et al (2011) Oxford Handbook of Forensic Medicine. Oxford University Press, Oxford.