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**Spontaneous DCC** (s-DCC) is a proposed terminal mechanism of respiratory arrest in individuals with diaphragm fatigue, primarily young infants with weak, underdeveloped inspiratory muscles. Most cases are thought to occur suddenly at night while asleep, triggered by diaphragmatic work overload in REM-sleep. It is highly lethal and rapidly progressive with only 5-10 s. before hypoxic syncope- and 3-5 min. until cardiac arrest ensue. It can be aborted by rescue breaths.

**Traumatic DCC** (t-DCC) is thought to be the most severe form of winding injury (celiac/solar plexus syndrome). It occurs from a heavy blow to the epigastrium or chest, stunning the diaphragm and inducing persistent spasm (cramp) and respiratory arrest. As above, this would rapidly proceed to syncope and cardiac arrest if rescue breaths are not administered quickly. This is in contrast to milder winding injuries which are more common and thought to cause short-lived diaphragm spasms and apneas, commonly experienced in martial arts for example.

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- 1 s-DCC probably occurs unwitnessed in bed at night and likely has exceptionally high mortality with few survivors who lived to talk about it. Most victims are young and preverbal. Also may not recall the event given it happens in sleep. Autoresuscitation is possible however a complex, counterintuitive task (breathing out to breathe).
  - 2 DCC is silent. Victim is unable to cry out for help because of inspiratory arrest.
  - 3 DCC is invisible to the naked eye because the diaphragm is an internal organ. It also mimics other conditions such as choking, seizures and sudden cardiac arrests. Effectively no window of opportunity to observe in vivo because of its spontaneous, unpredictable nature and need for specialized studies (e.g., fluoroscopy, D-EMG, continuous ultrasound).
  - 4 Similar to VFib, excitation of pump muscles do not persist postmortem. However, histological traces of DCC might remain at autopsy (diaphragm contraction band necrosis, disrupted myofibers and fibrous scars; *Kariks 1989, Silver 1992*).
  - 5 Standard autopsies in sudden death cases generally omit diaphragm histology. Also, no gross changes are visible, just microscopic.
  - 6 DCC terminates in cardiac arrest, thus mimicking sudden cardiac deaths.
  - 7 In non-monitored inpatients, critical apnea is silent, rapidly progressive (to syncope and cardiac arrest) and easily avoids detection. Even in those receiving respiratory monitoring, airflow is not typically measured, rather chest impedance (respiratory movements). Because of continued chest movements (in attempt to breathe against the obstruction of DCC), apnea alarm is not triggered. Also, where many false alarms occur, as is common on busy wards, apnea alarms do not receive immediate medical attention. Therefore, it is plausible the *apnea of DCC is being missed in both settings*. In addition, oxygen desaturation alarms are a late finding, thus missing the critical apneic event of DCC.
  - 8 In t-DCC, respiratory arrest, hypoxic syncope and death can be mistaken for traumatic cardiac arrests (asystole, VFib, VTach) and commotio cordis (VFib). [This is important because CPR priorities differ (chest compressions vs. rescue breaths in DCC).]
  - 9 Those who survive hypoxic syncope from t-DCC will likely have retrograde amnesia, unable to recall the respiratory arrest (e.g., collapse of an NFL player in 2023).

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DCC: diaphragmatic cramp-contracture, D-EMG: diaphragm electromyography, VFib: ventricular fibrillation, VTach: ventricular tachycardia

### Sources:

- Gebien DJ, Eisenhut M. Diaphragmatic cramp-like contracture (DCC) – A novel terminal mechanism in sudden unexpected deaths of all ages. *ResearchGate*. (2023).
- Gebien DJ. Blunt trauma respiratory arrest by diaphragm spasm and tetanic cramp-like contracture (DCC). *ResearchGate* (2023). DOI 10.13140/RG.2.2.13375.11681.
- Kariks J. Diaphragmatic muscle fibre necrosis in SIDS. *Forensic Sci Int*. 1989 Dec;43(3):281-91. PMID: 2613142.
- Silver MM, Smith CR. Diaphragmatic contraction band necrosis in a perinatal and infantile autopsy population. *Hum Pathol*. 1992 Jul;23(7):817-27. PMID: 1612581.

**Table 3 – Why diaphragm cramping is unknown to medicine.** Putative diaphragmatic cramp-like contracture (DCC) is a proposed mechanism of respiratory arrests individuals with critical diaphragm fatigue causing sudden unexpected deaths in all ages. There appears to be spontaneous and traumatic forms (winding injuries) amongst others. It has not been experimentally validated, rather based on a highly compelling case report. Speculation is provided as to how DCC has evaded detection.