1. DEFINING POSITIONAL ASPHYXIA
Positional Asphyxia is most simply defined as when the position of a person's body interferes with respiration, resulting in death from asphyxia or suffocation. ANY body position that obstructs the airway, OR that interferes with the muscular or mechanical components of respiration, may result in positional asphyxia. Restraint Asphyxia is death that occurs due to Positional Asphyxia that is caused by restraint.

To fully understand the deadly relationship between restraint asphyxia and forceful-prone-restraint, a basic understanding of respiratory physiology (normal breathing function) is required.

2. MECHANISM OF RESPIRATION
Effective respiration depends upon a combination of three critical elements:
1. Open airway;
2. Adequate exchange of oxygen and carbon dioxide between the lungs and the circulation system; and
3. A functional muscular pump or bellows system, to achieve airflow in and out of the lungs.

If any part of the upper or lower airway (i.e., nose, mouth or throat) becomes obstructed, respiration is impeded or completely prevented. If lung tissue or circulation is severely diseased, or damaged by injury, oxygen and carbon dioxide are not exchanged adequately and breathing is ineffective. Additionally, even with a completely open airway, perfectly healthy lungs and normal circulation, if a failure of the mechanical component of respiration occurs (the muscular pump or bellows system), effective respiration cannot be achieved.

An effectively functioning muscular pump or bellows system requires a combination of three critical elements:
1. Central Nervous System control of respiratory muscles;
2. Ability of the ribcage to be expanded and relaxed by various chest muscles (such as the intercostal muscles between the ribs); and
3. Ability of the diaphragm to contract and descend into the abdomen, displacing abdominal contents downwards and outwards.
When respiratory muscles are appropriately activated by the Central Nervous System, the ribcage is cued to expand, and the diaphragm is cued to descend into the belly, so as to create a larger internal chest/lung space. When this occurs, and the airway is open, air is “sucked” or inhaled, into the lungs. Relaxation of the diaphragm and the ribcage's muscles creates a smaller internal chest/lung space, and when the airway is open, air flows out of, of is exhaled from, the lungs.

3. IMPEDED BREATHING DURING RERAINT
If the size of the chest/lung space cannot be changed, no air movement occurs between the lungs and the external atmosphere. The inability to change the size of the internal chest space is the ultimate cause of restraint asphyxia.

When standing or sitting up-right, a healthy person uses both the intercostal muscles and the diaphragm to breathe. However, when a healthy person is lying down on their back (supine) or lying down on their front (prone), breathing is normally accomplished only by diaphragm movement.

When breathing becomes difficult, accessory muscles in the trunk, neck, and arms are automatically employed to assist the intercostal muscles and diaphragm in changing the internal size of the chest, creating the flow of air into and out of the lungs. But, when restrained, a person's muscular bellows system becomes significantly compromised. By forcefully compressing the shoulders and torso to a surface, chest expansion is seriously restricted or completely prevented. By forcefully compressing the person's diaphragm (lower back and/or hips) against a surface, diaphragmatic excursion and displacement of abdominal contents is seriously restricted or completely prevented. Thus, forceful-prone-restraint significantly restricts or prevents inhalation.

When forcefully-prone-restrained, an individual must lift his entire body off the surface he is placed upon – against physical pressure by staff – using only his abdominal muscles, simply to take in or let out a little bit of breath. The muscular act of breathing requires a greatly increased physical effort. Yet, this great effort achieves at best only the tiniest volume of breath.
4. EXTREME MUSCLE EXERTION DURING RESTRAINT
People who are at greatest risk of restraint asphyxia experience extreme muscle exertion prior to dying from restraint asphyxia. This is observable in two or three of the following phases.

PHASE 1 – PRE-RESTRAINT: The individual demonstrates an altered level of consciousness, and engages in irrational behaviors with violent, aggressive, and/or paranoid features – all of which cause him to experience extreme physical exertion. This altered level of consciousness with exertional-behavior activity is usually referred to as a state of "excited delirium."

Some states of excited delirium are the result of alcohol and/or drug use (often cocaine). However, states of excited delirium are also often produced by postictal states (excited altered levels of consciousness after seizures), diabetic hypoglycemia (excited altered levels of consciousness caused by low blood sugar), head trauma, excited manic-depression, or excited schizophrenic episodes.

Regardless of its cause, the excited delirium of Phase 1 results in profound physical exertion, producing extreme total body exhaustion. Persons with excited post-seizure or low blood sugar episodes, or persons with acute head injuries, can experience total body exhaustion in just a few minutes. Persons with chronic diseases can become exhausted much faster than otherwise "healthy" individuals, when experiencing excited delirium.

PHASE 2 – RESTRAINT INITIATION: Staff arrive, and quickly recognize that the individual's altered level of consciousness indicates the need for restraint. A struggle and/or chase ensues and the individual experiences additional extreme energy expenditure while running from or wrestling with staff.

Physical restraint usually begins with forceful prone restraint – often with one or more persons pressing too hard on the individual's back and/or hips. This extreme force immediately impedes the exhausted individual's ability to breathe.

PHASE 3 – CONTINUED STRUGGLE: The restrained individual will persist in his forceful and violent attempts to defeat and escape restraint, especially if there is a bio-chemical cause of his altered level of consciousness. His increased struggles is universally perceived by uneducated responders as being a struggle to defeat and escape restraint in order to harm himself or others. Thus, more and more force is applied, to keep the struggling individual in the prone position.
At this point, the energy required to fuel the individual's muscular ability to breathe is entirely absent. The forcefully prone restrained individual becomes lethally exhausted within seconds. He can enter respiratory arrest, closely followed by cardiac arrest.

5. HYPERCATABOLIC STATES AND METABOLIC ACIDOSIS
Besides exhausting the body's muscles, the violent muscular activity that occurs during each of these phases adversely effects the internal chemistry of the individual's body.

Extreme physical energy expenditure generates excessive production of adrenalin and noradrenalin ("catecholamines"). A progressively-increasing amount of these body chemicals occurs, creating a "hypercatabolic state." A hypercatabolic state weakens all the body's muscles, especially the respiratory muscles.

A hypercatabolic state also stresses the heart by increasing its workload (requiring faster- and stronger-than-normal contractions). Thus, the heart needs more than normal amounts of oxygen in order to keep functioning. If an individual with severe respiratory muscle fatigue, an increased heart workload, and an increased need for oxygen, is restrained in a body position that impairs or prevents breathing ... It is easy to understand why asphyxia occurs so quickly.

Research also suggests that the violent muscular activity that occurs during each phase causes an excessive "lactic acid" production, producing a profound metabolic acidosis associated with cardiovascular collapse following exertion in a restrained position. Metabolic acidosis is a state of body-chemical imbalance, that – by itself – can kill someone.


About the Author: Charly is an internationally-known emergency care author, EMS Instructor, Consultant, and Restraint Asphyxia Expert Witness. A paramedic since 1985 (nine years as a "Denver General" Paramedic), Charly is a seasoned prehospital emergency care provider. With her additional experience as a psychiatric medical technician and an Army National Guard helicopter medic, Charly is one of the country's most exciting and entertaining EMS educators.

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