

VERTEBRAL FRACTURES - TEARDROP



*“The Two Fridas”, oil on canvas, 1939, Frida Kahlo,
Museo de Arte Moderno, Mexico City.*

"I believe that by working I will forget the sorrows, and I will be able to be a little happier..."

My blood is the miracle that travels in the veins of the air from my heart to yours.

Frida Kahlo

I must have been 6 years old when I experienced intensely an imaginary friendship with a little girl more or less the same age as me. On the glass window of what at that time was my room, and which gave onto Allende Street, I breathed a vapour onto one of the first panes. I let out a breath and with a finger I drew a door....(hear Frida draws the window of her room)

Full of great joy and urgency, I went out in my imagination, through this "door". I crossed the whole plain I saw in front of me until I arrived at the dairy I called "Pinzon"....I entered by the "O" of Pinzon and I went down in great haste into the interior of the earth, where my imaginary friend was always waiting for me. I do not remember her image or her colour. But I do know that she was vivacious - she laughed a lot. Without sounds. She was agile and she danced as if she weighed nothing at all. I followed her in all her movements and while she danced I told her my secret problems. Which ones? I do not remember. But from my voice, she knew everything about me.....When I returned to the window I entered through the same door drawn on the glass pane. When? For how long had I been with her?. I do not know. It could have been a second, or thousands of years....I was happy. I blurred the "door" with my hand and it disappeared. I ran with my secret and my joy as far as the furthest corner of the patio of my house, and always in the same place under a cedar tree, I cried out and laughed, surprised at being alone with my great happiness and with the so vivid memory of the little girl.

Thirty four years have passed since I experienced the magic friendship and every time that I remember it, it revives and becomes larger and larger inside my world".

*Frida Kahlo, On the Origin of "The Two Fridas",
Diary, 1947.*

Frida Kahlo painted possibly her best work, certainly one of her most famous, shortly after her divorce from Diego Rivera, on 6th November 1939. Years later in her diary for 1947, she explained how when she was a child of just 6 years, she had had an imaginary friend. It was at the age of 6, that she had contracted polio which had left her with a wasted leg, a legacy which caused her great embarrassment and shame. She was teased relentlessly and without mercy, at school about her leg, and as an adult she would always wear long dresses to hide her deformity. As a young child being bullied at school, she created a fantasy world in her vivid imagination, one in which she escaped reality to be with a friend who liked her for what she was. On the frosty glass window of her bedroom, she would trace out an imaginary magic door, and just as Alice climbed through her magic looking glass Frida would climb through her magic door to spend time with her imaginary friend who was vivacious and laughed a lot - she was in fact a part of Frida - her strong self.

The double self-portrait would become one of Frida's most powerful motifs. Two aspects of her being - one vulnerable - one strong. Set in barren or forbidding landscapes, which enhanced the ice-cold chill of isolation, examples include some of her most famous works including, "Two Nudes in a Forest", 1939 and the arresting "Tree of Hope - Keep Firm" of 1946. But her most famous and most recognized dual personality motif is certainly "The Two Fridas", of 1939. On the day that her divorce was finalized, Frida was putting the finishing touches on the work. It clearly held great significance for her, it was the largest work she ever produced by far. The American Art historian MacKinley Helm was with Frida the day the divorce papers came through....

"....I had tea with Frida Kahlo de Rivera....on the December day in 1939 when there was handed into the studio a set of papers announcing the final settlement of her divorce from Rivera. Frida was decidedly melancholy. It was not she who had ordained the dissolution of the marriage, she said; Rivera himself had insisted upon it. He had told her that separation would be better for them both, and had persuaded her to leave him. But he had by no means convinced her that she would be happy or that her career would prosper when apart from him.

She was working then on her first big picture, a huge canvas called Las Dos Fridas...There are two full length portraits in it. One of them is the Frida that Diego had loved....the second Frida, the woman whom Diego no longer loves. There the artery is ruptured. The Frida scorned tries to stay the flow of blood, momentarily with a pair of surgeon's forceps. When the divorce papers arrived, while we were looking at the picture, I half expected her to seize the dripping instrument and fling it across the room..."

The double self-portrait is striking both in its massive size and in its nightmare imagery. An injured and bleeding Frida sits on the left, dressed in a white high-necked Victorian blouse, of a type worn in Mexico before the revolution. This is the Frida that her husband no longer loves. She holds hands with her strong imaginary friend who sits on the right dressed in the traditional clothing of the Tehuantepec. This is the Frida that her husband once loved. The duality of imagery works on different levels. It also represents the two cultures that Frida as a "mestiza" was a product of - on her father's side the pale European on her mother's side bronzed Amerindian. The connection between the two Fridas is not simply physical as represented by the holding hands - it is also deeply spiritual. Their hearts are part of the same circulatory system, connected by another strong motif of her work; the lines of interconnectedness of all life in the Universe. This motif usually involved ribbons, or vines, or even telegraph wires, but here the connection is much stronger - a blood vessel that carries that miracle of life to both Frida's; "My blood is the miracle that travels in the veins of the air from my heart to yours", she recorded in her diary.

Frida's medical background is another motif that is strongly evident. The Frida that Diego no longer loves is broken hearted. Her heart is cut open showing accurate detail of ventricular chambers, valves and papillary muscles. It has the look of a deliberate dissection. Was the hurt inflicted onto her deliberate? On the right image her heart is whole, the Frida that was loved by Diego. Though from separate realities the two hearts

beat as one. The Tehuana Frida holds in her left hand a miniature image of Diego as a child. Frida loves Diego as much as a mother loves her child. A vein appears to connect to the miniature from behind her hand. It then winds its way up her arm and runs into her uninjured heart. But then from here an artery emerges that gives life blood to the injured and broken heart of the unloved Frida. This Frida's heart struggles to keep up with the hemorrhaging artery that emerges from it. Frida is in danger of bleeding to death. The injured Frida tries to be strong. She clamps the bleeding artery in an attempt to stem the flow of blood, but try as she might, she cannot quite manage to fully control the bleeding. Drops of blood continue to fall onto her brilliant white dress dispersing themselves among the small red flowers that decorate it. No matter how cheerful Frida tries to be blood intermingles with the flowers. Frida used duality in symbolism derived from both sides of her heritage. The exposed heart was a ubiquitous symbol of Catholic Art going back to the Renaissance, in images such as the Sacred Heart of Jesus or the Immaculate Heart of Mary. But it was also a frequent image in pre-Columbian Art where it recurs as a symbol of life giving force. In savage Aztec ritual killing the heart was torn from the chest.

The 1930s were the apogee of Twentieth century Surrealism. When this work appeared it was loudly acclaimed as a magnificent example. But Frida never considered herself a "Surrealist". She never even cared for the Surrealists or their incomprehensible imaginings. Frida always maintained that she painted her reality - not her dreams or her nightmares. Her duality images are autobiographical and always deeply personal. When they appear, they are usually set against a backdrop landscape that is barren, forbidding, fractured. The Two Fridas show this motif.

Over three quarters of a century after her death the story of Frida Kahlo's life long struggle with chronic physical pain, legacy of the polio she contracted as a child and a horrific bus accident that almost killed her at the age of eighteen is now well known. What is far less well known is that she bore this burden with astonishing good grace and even humour. But Frida Kahlo also suffered a from a second kind of lifelong pain, much less well known. This was psychological, brought about by the incessant infidelities of her famous husband Diego Rivera and by her inability to have children. She could not give Diego up, nor could Diego ever give up Frida. They were always soul mates. Frida could have coped with her physical pain. She did cope with it. But it was her psychological pain that she could never cope with. Only her Art kept her alive; until drugs and alcohol took her life at the age of just 47 years, the same age of death as both as Edith Piaf and Judy Garland.

The world now sees Frida's most famous work, "The Broken Column" as the icon of her physical pain, but what most are less cognizant of is her second most famous work, "The Two Frida's", icon of her psychological pain. Frida Kahlo died as much of a broken heart as of any physical ailment.

When we see the image of a "broken column" in the form of a Vertebral Teardrop Fracture, we need remind ourselves that there are different kinds of injuries that may be hidden, even though all may appear the same from the outside!

VERTEBRAL FRACTURES - TEARDROP

Introduction

A **vertebral teardrop** fracture is a fracture of the **antero-inferior** corner of a vertebral body.

There are 2 types, based on the mechanism of action of injury:

1. **Flexion tear drop fracture**
2. **Extension tear drop fracture**

Radiologically the vertebral fractures look **similar** in both types. What distinguishes them is the **mechanism of injury**.

Making the distinction is critically important as the flexion type fracture is a far more significant injury, being very unstable with a high risk of associated spinal cord damage.

Treatment and prognosis of **flexion teardrop** fractures are variable and depends on the degree of injury. Due to the associated injury of both osseous and ligamentous structures, this fracture is usually unstable with almost all patients requiring **decompression** and **internal fixation**.

Extension teardrop fractures are considered much less severe and are often managed conservatively.

See also separate documents on:

- **Thoracolumbar Spine Clearance (in Surgery - Trauma folder)**
- **Spinal Motion Restriction - Head Holding**
- **Spinal Motion Restriction - Lateral Positioning**
- **Spinal Motion Restriction - Log Rolling**

Mechanism

Tear drop fractures are distinguished on the basis of the mechanism of injury.

Flexion teardrop:

This is an **axial compression** and **flexion** injury.

With the more severe injuries, structural failure occurs in a characteristic pattern with:

1. Fracture of the antero-inferior corner of a vertebral body leaving (classically) a triangular anterior fragment
2. Rupture of the anterior longitudinal ligament
3. Rupture of posterior longitudinal ligament
4. Rupture of posterior ligaments (ligamentum flavum, interspinous ligament)
5. Posterior translocation of the lower cervical column (in relation to the upper column), with possible retropulsed fracture fragments.
 - The degree of posterior translocation of lower versus upper spinal column at the level of injury strongly correlates with degree of neurological injury

The injury is unstable as all three spinal columns are disrupted.

Extension teardrop:

This is a **hyper-extension injury**

An extension teardrop fracture occurs when abrupt neck extension causes the anterior longitudinal ligament to avulse the antero-inferior corner from the remainder of the vertebral body, producing a triangular-shaped fragment

The injury is unstable in **extension** as the anterior longitudinal ligament is ruptured.

Classification

Flexion versus Extension Teardrop Fractures

TYPE	FLEXION TEARDROP	EXTENSION TEARDROP
Vertebral fracture	Antero-inferior corner of body <ul style="list-style-type: none"> • <i>May lose height from compression</i> 	Antero-inferior corner of body <ul style="list-style-type: none"> • <i>Generally no associated loss of height.</i>
Mechanism	Flexion & compression	Hyper-extension

Location	Tend to occur in the mid to lower cervical spine – most commonly C4, C5, C6.	Tend to occur in the upper cervical spine – most commonly C2
Stability	Very unstable	Stable in flexion <i>And</i> Unstable in extension
Associated injuries	Extensive ligamentous injury – posterior displacement of vertebral body into the spinal canal Spinal cord injury is common: <ul style="list-style-type: none"> • <i>Anterior cervical cord syndrome</i> • <i>Quadriplegia.</i> 	Central cord syndrome may occur.

Complications

Flexion teardrop:

Flexion teardrop fractures are very unstable injuries, with high risk of associated spinal cord injury secondary to translocation of the lower cervical column / retropulsed fracture fragments.

Anterior spinal cord syndrome can result

Total quadriplegia can occur.

Extension teardrop:

This is a much more benign injury compared to the flexion types fracture

The injury is stable in flexion but may be unstable in **extension**

Central cord syndrome may occur.

Clinical Features

As for any significant fractures, findings at the site of injury may include:

1. Swelling
2. Ecchymosis
3. Deformity
4. Pain
5. Tenderness

As there is a high risk of neurological injury, especially with flexion type injuries a careful and full neurological examination must be undertaken.

Appropriate spinal precautions must be observed at all times.

The long-term prognosis of the flexion teardrop injury mostly depends on the degree of neurological injury. Although milder cord injuries may be asymptomatic or have few neurological sequelae, injury with posterior column translocation, in particular, is associated with paralysis and quadriplegia.

Investigations

Plain radiography

Plain radiography is no longer recommended as first line imaging of the spine. If undertaken however (e.g. for lack of resources), then the following may be found:

Flexion teardrop fracture

The most characteristic findings include:

1. Fracture of the antero-inferior lip of vertebral body:
 - Classically a triangular fragment (teardrop sign)
 - Larger fragments may not appear triangular
 - Anterior fragment often minimally displaced
2. Posterior displacement of the posterior vertebral body relative to the intact inferior cervical column

Depending on the fracture severity, additional findings may include:

3. Variable fracture of the vertebral body
 - Loss of anterior height of the vertebral body

- Sagittal fracture through the vertebral body
 - Vertebral body rotation with an AP diameter that appears smaller than on other levels
4. Abnormal spinal alignment - often less apparent if imaging occurs after traction is performed
 - Cervical kyphosis
 - Disruption of the spino-laminar line
 - Widening of inter-spinous processes
 - Anterior dislocation of the facet joints
 5. Intervertebral disc space narrowing (disco-ligamentous injury)
 - More common inferior to the posterior vertebral body fragment versus anterior fragment
 6. Additional spinal fractures at other levels:
 - Burst type 2 fractures.

Extension teardrop fracture

The is an anterior-inferior corner fracture with the following features:

1. avulsion fracture from the attachment of the anterior longitudinal ligament to the inferior corner of the vertebral body, usually a thin fracture fragment
2. the fragment is triangular in a shape reminiscent of a teardrop
3. vertical height of fragment is equal to or greater than width
4. anterior disc space widening

CT Scan / CT angiogram

CT scan is the preferred initial imaging modality for all spinal injuries.

It is mandatory for an accurate classification of injury to the 3 columns of the spine.

Because of the risk of associated spinal fractures - the whole spine should be imaged.

CT angiography may also be indicated to screen for associated vascular injury.

MRI

MRI is done to assess

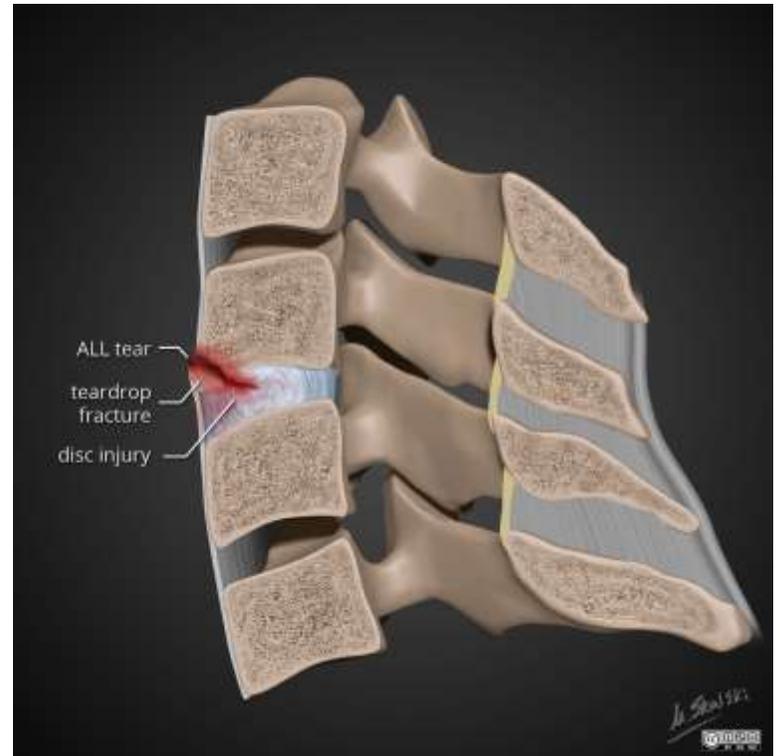
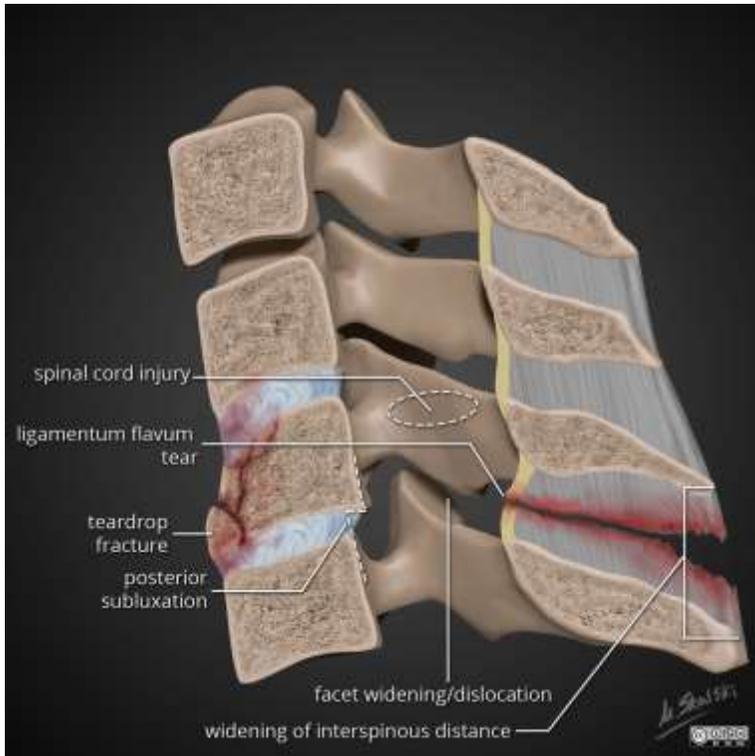
1. Possible damage to the spinal cord.
2. Other injuries not readily detected by CT scan
 - Epidural hematoma

Management

Treatment and prognosis of **flexion teardrop** fractures are variable and depends on the degree of injury. Due to the associated injury of both osseous and ligamentous structures, this fracture is usually unstable with almost all patients requiring **decompression** and **internal fixation**.

Extension teardrop fractures are considered much less severe and are often managed conservatively.

Appendix 1



Left: The features of a flexion teardrop vertebral fracture. Right: The features of an extension teardrop vertebral fracture, (Matt Skalski, Radiopedia).

References

1. Andrew Murphy, Hugh Harvey, Flexion teardrop fracture in Radiopaedia website:
 - <https://radiopaedia.org>
2. Craig Hacking, Frank Gaillard; Extension teardrop fracture in Radiopaedia website:
 - <https://radiopaedia.org>
3. Amy Kaji et al. Spinal column injuries in adults in Up to Date Website; November 2018.

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