GREENE COUNTY MEDICAL EXAMINER'S OFFICE

January 3, 2023

Deiter Duff, MD

MISSION AND VISION

- **The primary mission is to provide quality medical examiner services for Greene County**
  - Death investigation
  - Forensic pathology: autopsies and testimony
  - Death certification
  - Record keeping
- Secondarily, plan to become a center for forensic pathology services for Southwest Missouri
- Expansion of services to other counties will help with the primary mission to Greene County

STAFF

- **Medical Examiner**: Deiter Duff
- **Chief Forensic Investigator**: Tom Van De Berg
- **Forensic Investigator II**: Michael Lamphere and Joshua Moore
- **Administrative Coordinator**: Teresa Wallace
- **Part-time Death Investigators**: Currently 5

We have investigators on 24/7, with backup available for complicated cases

MEDICAL EXAMINER CASES

Missouri Statutes define which cases require investigation

58.720. 1. When any person dies within a county having a medical examiner as a result of:

(1) **Violence** by homicide, suicide, or accident;

(2) **Thermal**, **chemical**, **electrical**, or **radiation** injury;

(3) **Criminal abortions** including those self-induced;

(4) Disease thought to be of a hazardous and contagious nature or which might constitute a **threat to public health**; or when any person dies:

(a) **Suddenly** when in apparent good health;

(b) When **unattended** by a physician, chiropractor, or an accredited Christian Science practitioner, during the period of thirty-six hours immediately preceding his death;

(c) While in the **custody** of the law, or while an inmate in a public institution;

(d) **In any unusual or suspicious manner**

http://www.moga.mo.gov/mostatutes/stathtml/05800007201.HTML

GCMEO 2021 STATS

- 5174 calls reporting deaths
- 1149 death certificates signed
- 376 postmortem examinations

GCME 2021 STATS CONT.

- Of the 376 postmortems
  - 187 accidents
  - 78 natural deaths
  - 66 suicides
  - 37 homicides
  - 6 undetermined
  - 2 were pending at the time stats were compiled

GCME 2021 STATS CONT.

- 135 drug intoxication deaths
- 78 gunshot wound deaths
- 29 motor vehicle fatalities
- 12 deaths ages 1-17
- 2 infant deaths

CAUSE AND MANNER OF DEATH

CAUSE OF DEATH

- Cause: disease or injury that initiated the chain of events that brought about a person's death – PROXIMATE CAUSE

EXAMPLES: CAUSE OF DEATH

- Atherosclerotic cardiovascular disease
- Hypertensive cardiovascular disease
- Pulmonary thromboembolism due to deep vein thrombosis
- Ruptured esophageal varices due to cirrhosis
- Gunshot wound of head
- Stab wound of chest

EXAMPLES OF UNACCEPTABLE CAUSES OF DEATH

- Cardiac Arrest
- Cardiopulmonary arrest
- Old age
- Brain failure
- Coma
- Shock

MANNER OF DEATH

(1) Natural
(2) Accident
(3) Homicide
(4) Suicide
(5) Undetermined

HOW CAUSE AND MANNER OF DEATH ARE DETERMINED

- Not just the autopsy
- Scene investigation, police reports, medical records
- Example: decedent with scalp lacerations, skull fractures, and brain injury
  - Struck with hammer = homicide
  - Fall = accident
    - Or perhaps if pushed, homicide
    - Or if they jump from a building, suicide
  - Motor vehicle collision = accident
    - Or if vehicle was intended to be used as a weapon, homicide

CASE

- 32 year old man
- Got off work at 11:00 PM, went home, took shower, went to get something to eat, collapsed on floor
- Wife started CPR

- Reported history of collapsed lung as pre teen, early degenerative disease of spine, no other known medical history
- Paternal great grandfather died at 40
- Paternal grandfather has aneurysm (location not known)
- Mother's sister has aortic aneurysm

- Is an autopsy needed? Release body? Toxicology only?

AUTOPSY FINDINGS

- Rupture of ascending aorta, histologic findings of severe medial degeneration
  - Hemopericardium (200 ml)
  - Left hemothorax (200-300 ml)
  - Hemoperitoneum (100-200 ml)
- Moderate coronary atherosclerosis

Blood:

Alcohol:

Ethanol:	Negative
Acetone:	Negative
Isopropanol:	Negative
Methanol:	Negative

Blood Drug Screen:

Amphetamines:	Negative
Antidepressants:	Negative
Barbiturates:	Negative
Benzodiazepines:	Negative
Cannabinoids (THC):	Negative
Cocaine/Metabolites:	Negative
Lidocaine:	Negative
Methadone:	Negative
Non-Opiate Narcotic Analgesic:	Negative
Opiates:	Negative
Phencyclidine:	Negative
Phenothiazines:	Negative
Propoxyphene:	Negative
Acetaminophen:	Negative
Oxycodone:	Negative
Fentanyl:	Negative
Oxymorphone:	Negative

CAUSE AND MANNER OF DEATH?

- Cause: Pericardial tamponade due to a ruptured ascending aorta
- Manner: Natural

- Are we done?

John Welsh
Cardiovascular Diagnostic Laboratory

The Lillie Frank Abercrombie
Section of Cardiology
Department of Pediatrics

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Houston, Texas 77030
TEL: (832) 824-4155
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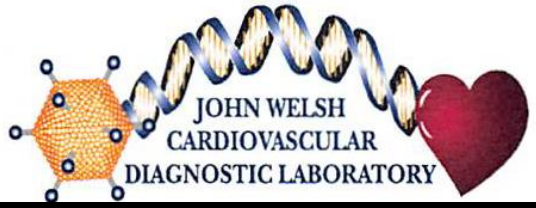

BCM
Baylor College of Medicine

RESULT:

Gene	DNA Change	Amino Acid Change	Zygosity	Classification
COL3A1	c.782G>A	p.Gly261Asp	Heterozygous	Pathogenic

RECOMMENDATION:

Targeted analysis for additional family members for the variant identified in the COL3A1 gene is recommended. Due to the autosomal dominant mode of inheritance of COL3A1 mutations, as well as variability in clinical presentation and severity, we recommend genetic counseling for this individual and his family.

- The mother took the children for testing, all three were positive for the genetic mutation
- Children taken to pediatric genetic specialist at Johns Hopkins

Plan:

JOHNS HOPKINS MEDICINE

1. Consider 1 gram of Vitamin C (cross-link for collagen in the body)

2. Avoid constipation, this can often be controlled with diet. If laxative is used, it should be a bulk laxative like miralax. Avoid bowel-stimulating medications.

3. Obtain yearly echocardiogram.

4. Obtain MRA head, neck, chest, abdomen, pelvis every two years starting between the ages of 7-9 yo.

5. Individuals with a predisposition to aortic aneurysms should remain active. Avoidance of contact or competitive sports, isometric exercises such as sit-ups, push-ups, pull-ups, weightlifting, and rope-climbing and exercising to exhaustion is recommended. Aerobic (moving) activities done for fun and in moderation are highly encouraged to naturally lower heart rate and blood pressure. Low impact activities, especially water activities such as swimming, are excellent activities to reduce injury to loose joints. While most activities are fine in early childhood, some consideration should be given to the ultimate need to restrict certain activities in later life. Taking away a sport with which the child strongly identifies can be traumatic. We suggest steering young children toward activities that they can safely maintain throughout life.

6. Begin Losartan 25mg twice per day.

CAUSE OF DEATH?

- Pericardial tamponade due to a ruptured ascending aorta due to vascular Ehlers-Danlos syndrome

- Comment: Genetic testing revealed a variant in the COL3A1 gene. Genetic counseling for family members is recommended.

Severe Medial Degeneration of the Ruptured Ascending Aorta in an Autopsy Case with a Pathogenic COL3A1 Heterozygous Missense Mutation

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Disclosure

The authors of this abstract have indicated that they have no conflicts of interest that relate to the content of this abstract.

Background

Vascular Ehlers-Danlos syndrome (vEDS) is a life-threatening connective tissue disorder because of its high risk of spontaneous arterial and organ rupture. Abnormal type III collagen synthesis caused by pathologic mutations in the COL3A1 gene is the underlying mechanism of vEDS.

Methods

In this study, we investigated the pathological changes of the ruptured aorta and the surrounding normal appearing aorta of a previously healthy 32 year old male with sudden death due to cardiac tamponade (Fig. 1) due to ascending aorta rupture by application of the recent consensus statement on surgical pathology of the aorta (Cardiovascular Pathology 25 (2016)247-257)). Meanwhile, genetic analysis of a gene panel containing 20 genes (including COL3A1) known to be associated with aortic diseases was ordered from John Welsh Cardiovascular Diagnostic Laboratory, Houston, USA.

Results

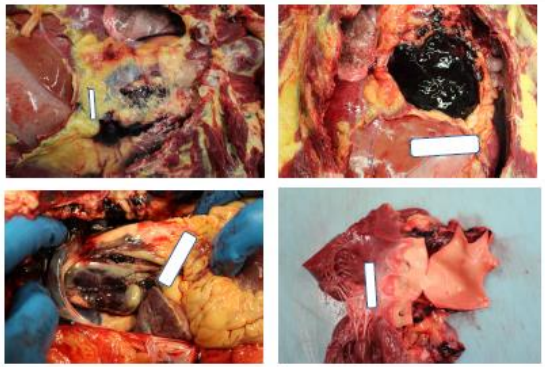


Fig. 1. Gross illustration of ruptured ascending aorta. A-C: sequential images of aortic rupture and cardiac tamponade; D: gross image showing ascending aorta tear.

Severe medial degeneration including multifocal mild intralamellar and translamellar mucoid extracellular matrix accumulation, patchy loss of smooth muscle cell nuclei, and focally mild to severe elastic fiber loss and disorganization by elastin stain in the ruptured ascending aorta and surrounding normal appearing aorta was identified (Fig. 2-5). Genetic analysis revealed a known pathological heterozygous COL3A1missense mutation (COL3A1, NM_00090, c. 782G>A (p.Gly261Asp)) in the deceased. Further genetic testing of the three children revealed that they all have this specific mutation.

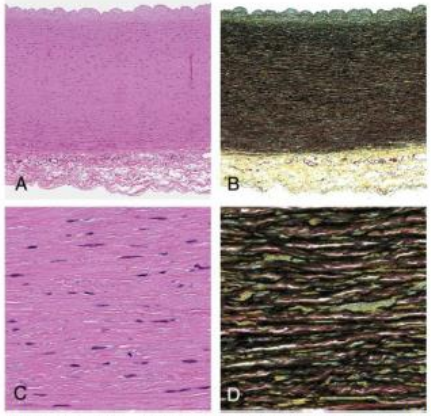


Fig. 2. Normal aorta, young adult (Cardiovascular Pathology 25 (2016)247-257). A:Three aorta layers: intima at the luminal surface (top), media, and adventitia (50x, H&E). B: The media consists of multiple lamellar units highlighted by the black lines of elastic laminae.(50x, Movat's pentachrome). (C) Higher magnification of the media showing distinct lamellar units with slightly more eosinophilic and refringent elastic laminae. (500x, H&E). (D) The lamellar units at higher magnification. (500x, Movat's pentachrome).

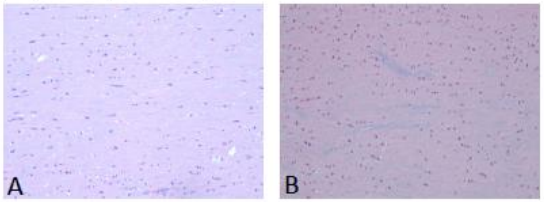


Fig. 3. Mucoid extracellular matrix accumulation (MEMA). A: Intralamellar MEMA; B: Translamellar MEMA. (H&E, 200x)

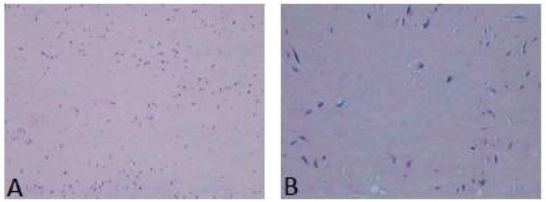


Fig. 4. Patchy smooth muscle cell nuclei loss (H&E, A:200x; B:400x)

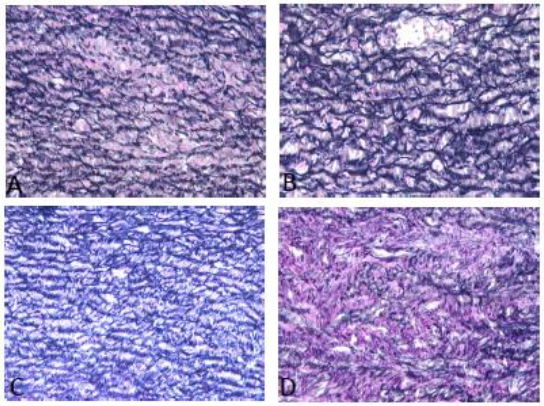


Fig. 5. A-B: focal elastic fiber fragmentation and/or loss (Elastin stain, 200x); C-D: Severe elastic fiber disorganization (Elastin stain, A-200x, B-400x).

Conclusions

Through combined microscopic and genetic analysis, our study not only revealed vEDS as the underlying disease causing a sudden ascending aortic rupture but also correlated the microscopic changes of the ruptured aorta with this specific COL3A1 mutation for the first time. Moreover, expanded application of combined microscopic and genetic analysis may help find underlying heritable mutations in family members of sudden aortic rupture cases with unknown etiology. The positive genetic results of the children prompted the mother to have them seen by a connective tissue disease expert who put them under prophylactic drugs and will follow up with them periodically to monitor pathological change with echocardiography and to predict the risk of sudden aortic rupture. This further underscores the value of autopsies for family members who may be at risk for a genetic condition.

CASE

- 56 year old female
- Possible overdose
- Husband says “she wasn’t acting right”
- He called an ambulance but she refused to go to the hospital
- ***Coroner says there was antifreeze at the residence and the husband said he didn’t buy it***

- Is an autopsy needed? Release body? Toxicology only?

AUTOPSY FINDINGS

- Pulmonary congestion and edema
- Moderate to severe coronary atherosclerosis

Positive Findings:

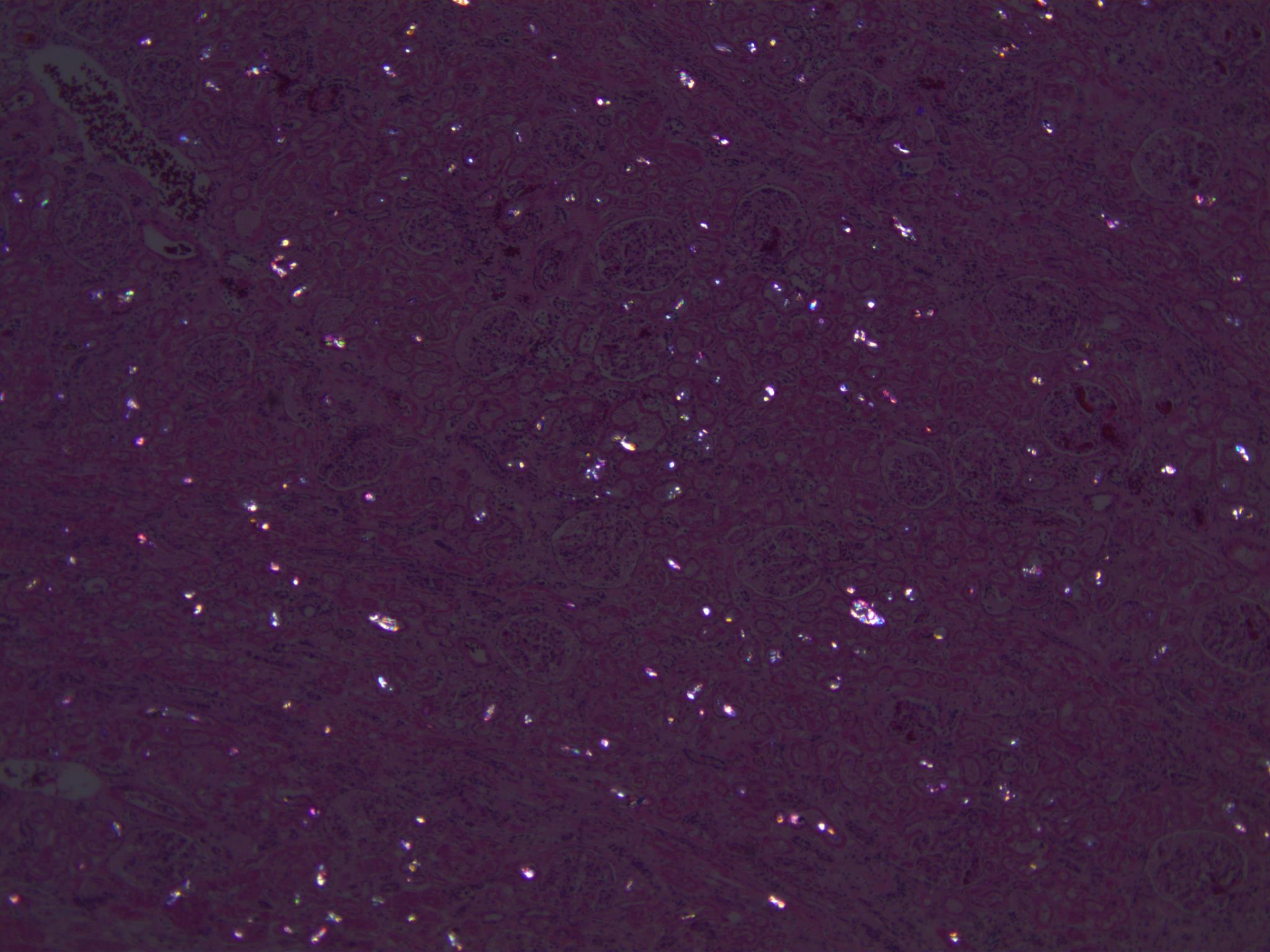
Compound	Result	Units	Matrix Source
Ethylene Glycol	100	mg/dL	001 - Cardiac Blood
Caffeine	Positive	mcg/mL	001 - Cardiac Blood
Cotinine	Positive	ng/mL	001 - Cardiac Blood
Lorazepam	57	ng/mL	001 - Cardiac Blood
Creatinine (Vitreous Fluid)	1.1	mg/dL	003 - Vitreous Fluid
Sodium (Vitreous Fluid)	130	mmol/L	003 - Vitreous Fluid
Potassium (Vitreous Fluid)	>20	mmol/L	003 - Vitreous Fluid
Chloride (Vitreous Fluid)	113	mmol/L	003 - Vitreous Fluid
Urea Nitrogen (Vitreous Fluid)	27	mg/dL	003 - Vitreous Fluid

See Detailed Findings section for additional information

Testing Requested:

Analysis Code	Description
8052B	Postmortem, Expanded, Blood (Forensic)
2062B	Ethylene Glycol, Blood
1919FL	Electrolytes and Glucose Panel (Vitreous), Fluid (Forensic)

- Histology
  - Birefringent crystals in kidneys, some fan-shaped (Calcium oxalate crystals)



- Cause of death: Ethylene glycol toxicity
- Manner of death determined by coroner for this case

CASE

- 40 year old man
- Paralyzed by GSW of head
- Died 33 years later

What would you like to know?

1. President Reagan waves to crowd immediately before being shot.
2. Shots have been fired. The president is in the limousine to the right. Guards move in on the gunman.
3. Secret Service agents join the commotion while other people take cover.
4. Washington, D.C. police officer Thomas Delahanty (foreground) and Press Secretary James Brady (behind) lie wounded on the ground. Two Secret Service agents reach for what appears to be the gun that had been fired.

https://upload.wikimedia.org/wikipedia/commons/9/90/Reagan_assassination_attempt_montage.jpg

DELAYED HOMICIDE

- James Brady, former White House press secretary
- Shot during an assassination attempt on Ronald Reagan 3/30/81
- Died 8/8/14

Cause of death: Gunshot Wound of the head and consequences thereof

Manner of Death: Homicide

http://gawker.com/james-bradys-death-ruled-homicide-161

"Jim had been long suffering severe health consequences since the shooting."

Family spokesperson

http://www.nytimes.com/2014/08/09/us/james-brady-s-death-ruled-a-homicide-police-say.html?_r=0

Cause and manner?