forensic sciences

MDPI

Case Report

Recent Case Reveals a Nineteenth Century Trauma Analysis and Presentation of a Skull as Evidence in a Homicide Trial

Heather Garvin [1,*], Lindsey Hohulin [1], Alexis VanBaarle [1] and Andrew Wilson [2]

[1] College of Osteopathic Medicine, Des Moines University, Des Moines, IA 50312, USA; lindsey.hohulin@unitypoint.org (L.H.)
[2] Iowa Donor Network/Iowa Office of the State Medical Examiner, Ankeny, IA 50023, USA
* Correspondence: heather.garvin-elling@dmu.edu

Abstract: Following a recent death, a human skull was found in a worn physician bag at the decedent's residence. The bag was labeled with the name "G.B. Ward", who was found to be a practicing physician and surgeon in the late 1800s, and contained historic medical paraphernalia and letters and receipts dated to the late 1890s. A forensic anthropological analysis of the skull concluded that it was not of modern medicolegal significance but revealed certain inconsistencies with standard professionally prepared anatomical specimens. This initiated further investigation into the history of G.B. Ward, which ultimately resulted in the circumstantial identification of the skull and revealed more than forty detailed newspaper accounts of its evidentiary use in an 1895 homicide trial in the rural United States. Ultimately, the Prosecution's argument was likely based on the misinterpretation of a transmaxillary (Le Fort) fracture, which had yet to be defined in the medical literature. This case study emphasizes the importance of investigative and forensic anthropological efforts and cautions against cursory designations of skeletal remains as medical specimens. It also highlights the early recognition of the evidentiary value of skeletal remains in court cases and pioneering efforts in performing forensic skeletal trauma analyses.

Keywords: forensic anthropology; Le Fort fractures; history; blunt force trauma; identification; medicolegal significance

check for updates

Citation: Garvin, H.; Hohulin, L.; VanBaarle, A.; Wilson, A. Recent Case Reveals a Nineteenth Century Trauma Analysis and Presentation of a Skull as Evidence in a Homicide Trial. *Forensic Sci.* **2023**, *3*, 245–257. https://doi.org/10.3390/forensicsci3020018

Academic Editors: Ricardo Jorge Dinis-Oliveira, Francisca Alves Cardoso and Pier Matteo Barone

Received: 9 March 2023
Revised: 24 March 2023
Accepted: 29 March 2023
Published: 5 April 2023

Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

In 2020, a worn physician bag labeled "G.B. Ward" was discovered at an Iowan residence amongst the personal effects of a recent decedent. Griffy Benjamin Ward, the recent decedent's grandfather, was an Iowan physician and surgeon in the late 1800s. Inside the bag, there were various historic artifacts and a human skull (Figures 1 and 2). The bag and its contents were sent to the medical examiner's office and a forensic anthropological analysis was requested to determine whether the remains were of forensic significance. The skull exhibited anatomical preparation hardware, but it was inconsistent with standard professionally prepared specimens. A historical investigation was conducted, revealing detailed newspaper accounts of an 1894 homicide and subsequent trial, in which the skull played a major evidentiary role. This case report aims to put the forensic anthropological findings in the context of the historical information, as it provides an early U.S. account of skeletal trauma analysis and the presentation of skeletal remains as trial evidence. This trial occurred prior to the formal establishment of forensic anthropology [1]; therefore, this study also highlights the evolution of skeletal trauma interpretation in the last century. Lastly, this case emphasizes the complex history of some anatomical specimens and the need to consider contextual information when evaluating forensic relevance.

Figure 1. Dr. Ward's physician bag and some of its contents. Bottom right depicts bottles of strychnine granules and petroleum emulsion. Labels from the petroleum emulsion are presented in the top right. The top one reads "SHAKE WELL. Dose, one to two top fuls, clear or in milk cream, wine, water . . . vehicle. To be taken after meals and . . . Milk or wine covers all taste of the . . . ". The other label reads "A palatable substitute for cod-liver oil or other carbohydrates and their compounds . . . indicated in Phthisis, Bronchitis, and Pneumonia and its Sequelae. Useful in diseases generally of Mal-nutrition or General Debility, and in Parasitic, Gatarrhal, Inflammatory, and Ulcerative Diseases of all the Mucous Membranes".

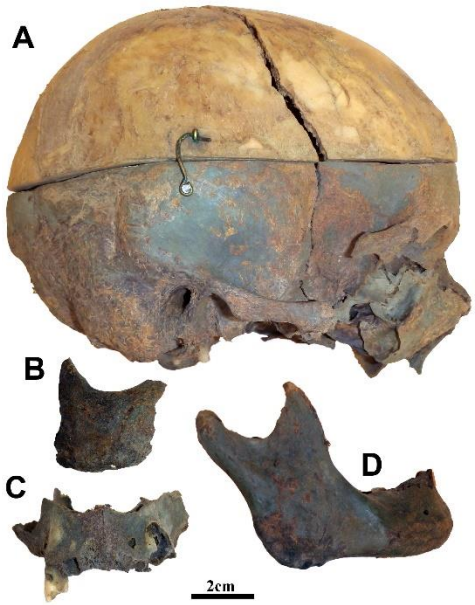

Figure 2. Skull elements present illustrating overall taphonomic pattern. (**A**) Right lateral view of cranium. (**B**) Anterior view of right zygomatic fragment. (**C**) Anterior view of maxillary fragment. (**D**) Right lateral view of mandible.

2. Case Report

2.1. Forensic Anthropological Assessment

2.1.1. Associated Material Artifacts

Besides the skull, the physician's bag contained ten bottles/vials, some of which were medicinal remedies (Figure 1). Labels were present on some bottles and included strychnine

(granules present), petroleum emulsion (milky liquid present), collodium iodoformatum, and sulfate of quinia. There were dozens of letters and other written documents addressed to Dr. Ward and dated to the 1890s, including receipts for train transports and care of horses, tax documents, hotel receipts, and correspondences with another physician. Safety pins, cut tacks, and thread spools were also present, as was an advertisement for the volume "*A System of Surgery. By American Authors. Edited by Frederic S. Dennis, M.D*".

2.1.2. Taphonomic Modifications

The cranium had a complete saw cut through the vault, consistent with sectioning during autopsy or dissection for brain extraction (Figure 2). The cut surfaces displayed irregular linear striations, a stepped-like surface relief, changes in cutting direction, and incomplete cuts on the ectocranial surface—characteristics that are most consistent with a manually powered saw (Figure 3) [2,3]. Note that Stryker saws, the first electric oscillating saws to be used on bone, only became commercially available in 1948 and the earliest patents for other types of electrically powered surgical saws date back to 1890 [4].

Figure 3. Macroscopic view of autopsy cut to calvaria illustrating uneven relief to the cut surface and changes in cutting directions. (**A**) Superior view of cut surface. (**B**) Oblique lateral/ectocranial view of cut surface.

The occipital condyles had multiple superficial sharp force defects, consistent with the disarticulation of the cranium at the atlanto-occipital joint. Endocranially, a section of the left petrous portion was excised (Figure 4). In anatomical dissections, it is not uncommon to remove a segment of the petrous portion to examine the contents of the middle ear cavity [5], and postmortem evaluations of the middle ear cavity for signs of pathology were in practice prior to the 1850′s [6].

There was an incomplete cut to the zygomatic process of the left maxilla (Figure 5). Stereoscopic examination revealed relatively straight defect margins, with a square-shaped kerf (~1 mm wide) that became more narrow, shallow, and u-shaped towards its lateral trailing edge. There were two groups of small (<2 mm diameter) circular defects on the ectocranial surface of the calotte, which did not fully perforate the bone and were anthropogenic in origin (Figure 6). The two circular defects on the left parietal were adjacent to a set of linear, parallel cut marks with v-shaped kerfs (Figure 6). These defects were positioned within an approximately rectangular area of bone that was devoid of connective tissue. Although these taphonomic defects are of unknown etiologies, their position on either side of a cranial fracture could possibly suggest an attempt to affix something to bridge the fracture for stabilization.

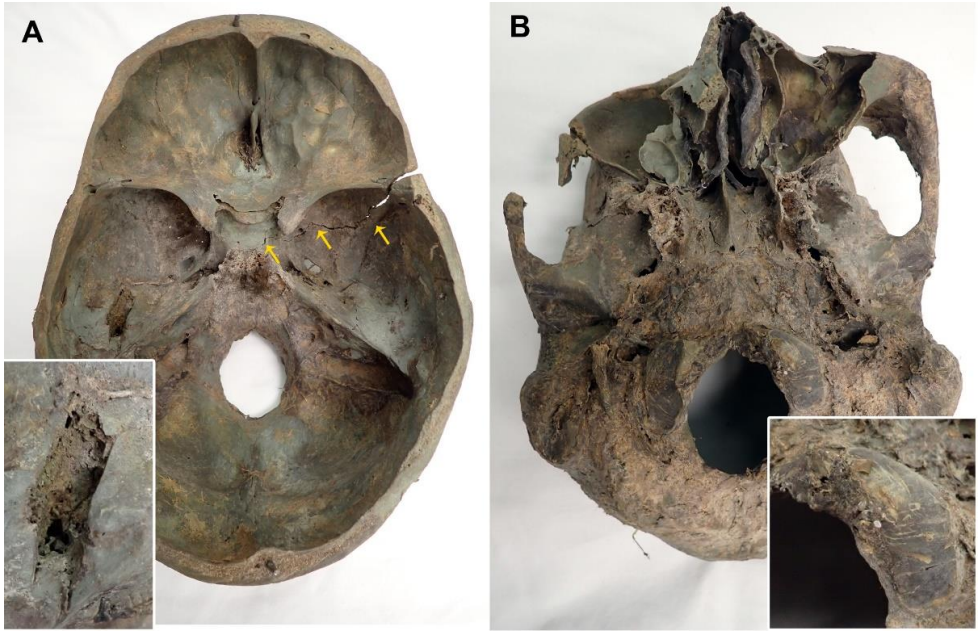

Figure 4. Endocranial view (**A**) and inferior view (**B**) of cranium. (**A**) Yellow arrows identify linear fracture extending endocranially to the sella turcica. Inset is a macroscopic view of the excised section of the left petrous portion. (**B**) Inferior view illustrating remnant soft tissue adhering to the cranial base and nasal conchae and cut marks to the occipital condyles. Inset is a macroscopic view of the left occipital condyle sharp force defects.

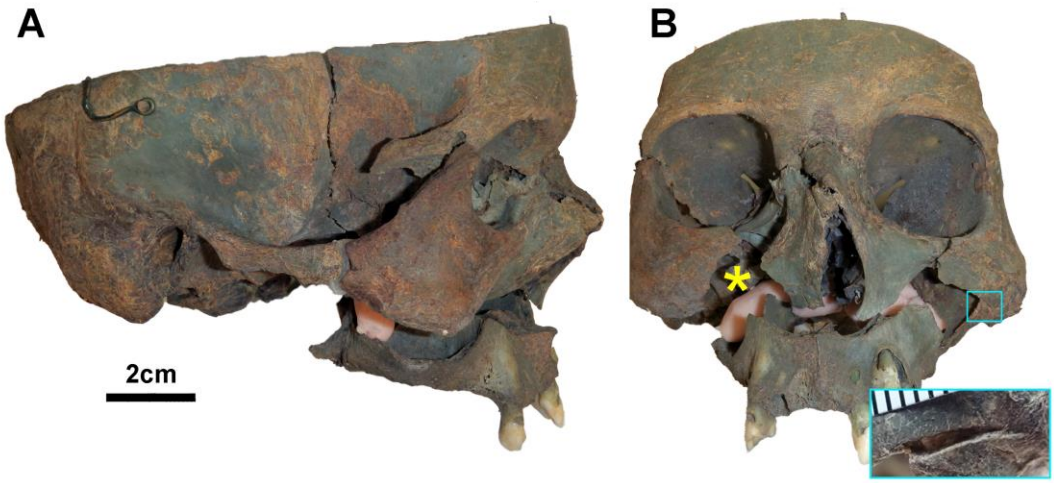

Figure 5. View of cranium with zygomatic and maxillae reconstructed (articulated via Sculpey beige, non-drying clay). (**A**) Right lateral view. (**B**) Anterior view. Asterisk indicates general area of blunt force impact. Inset depicts macroscopic image of cut mark. Note plastic deformation to right maxillary region and right zygomatic process of the frontal bone.

Small nails, eye-hooks, and metal wire hooks were affixed on the temporal and parietal bones to latch and secure the calotte, along with metal pegs in the cut margins. Although similar hardware is used in modern anatomical specimens, the fixtures in this case were not of the professional quality observed in most contemporary anatomical specimens (Figure 2).

Dust was present in the orbits, along fracture margins, and in other crevices. There were trace remnants of mummified connective tissue adhered to most of the ectocranial surfaces, as well as preserved tissue at the cribriform plate and surrounding the nasal conchae (Figures 2–5). While the calotte retained a natural color, the remaining portions of the cranium and mandible had a uniform darker stain with a green hue (Figures 2–5) that

appeared homogenous throughout the layers of bone (i.e., not surface staining). The green staining appeared consistent with submersion in some type of chemical/preservation fluid, to which the calotte was not subjected.

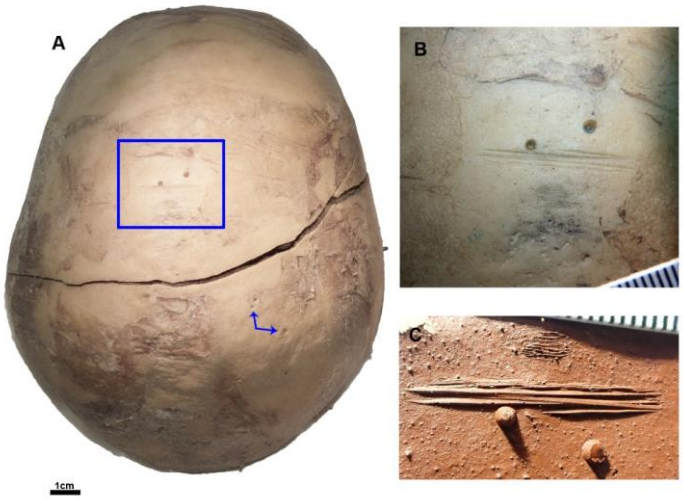

Figure 6. Superior view of calotte illustrating defects. (**A**) Overall view depicting linear fracture, circular defects (blue rectangle and blue arrows), and sharp force defects (blue rectangle). (**B**) Macroscopic view of region in blue rectangle depicting the circular defects and adjacent sharp force defects. (**C**) Macroscopic view of negative molds of the defects.

Cumulatively, the taphonomic modifications were consistent with a historic anatomical specimen [4,7,8], further supported by the associated material artifacts and case context.

2.1.3. Trauma

The cranium displayed evidence of perimortem blunt force trauma. A linear fracture extended between the right cranial base (sphenoid) and the left parietal (inferior to the temporal lines), traversing through the right temporal and right parietal bones (Figures 2, 4 and 6). While the fracture extended endocranially to the sella turcica, ectocranially, it terminated at the pterygoid plates. There is a visible gap between fracture margins. The characteristics of the fracture, including plastic deformation, uniform coloration/dust accumulation of the fracture margins, and continuity of the fracture across the autopsy cut, were consistent with an anthropological perimortem timing (i.e., when the bone retained its viscoelastic properties) [9]. Two additional parietal fractures branched from this large fracture in the region of the right temporal lines; one directed slightly anterior and inferior, terminating just above the autopsy cut and a second extending posterior and slightly superior at a short distance (~20 mm) (Figures 2 and 7). This right parietal region containing all three fractures represents an area of blunt force impact.

There was additional evidence of perimortem blunt force trauma to the right maxillary region with a tripod (i.e., zygomaxillary) fracture and multiple fractures to the right orbit, right frontal process of the maxilla, nasal bones, and right zygomatic process of the frontal bone (Figures 2, 4 and 7). The right maxillary body and nasomaxillary region was displaced posteriorly and medially, indicating an anterolateral impact to the right facial region. A bilateral transmaxillary fracture (i.e., Le Fort I fracture) resulted in the complete separation of the maxillary alveolus. There were additional fractures to the infraorbital region of the left maxilla, exposing the maxillary sinus. Many of the fractures displayed plastic deformation, particularly those of the right maxillofacial region and the right zygomatic process of the frontal bone.

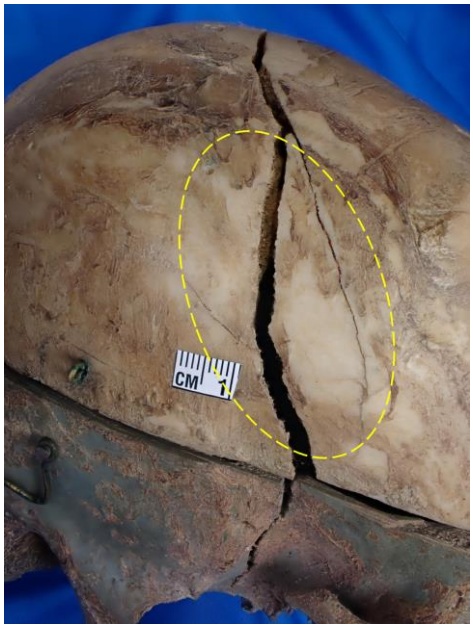

Figure 7. Oblique view of the right cranial vault (parietal region) depicting diverging linear fractures. This region, depicted by the dashed oval, is interpreted as a blunt force impact site.

Given the spatial distribution between the cranial vault fractures and the facial fractures and the posterior displacement of the maxillary fractures (indicating a different direction of force than the vault impact), a minimum of two blunt force impacts was reported: one to the right parietal and one to the right maxillary region (Figures 5 and 7).

2.1.4. Biological Profile

The biological profile was consistent with an adult male of European ancestry. The spheno-occipital synchondrosis was completely fused, and the pattern of cranial suture closure was consistent with a middle- or older-aged adult [10,11]. Sex and ancestry were assessed from morphoscopic traits. Cranial trait analysis using Walker (2008) returned a male sex estimate with an 84% probability [12]. Seven morphoscopic cranial traits input into the hefneR program [13,14] returned a 97% probability of European ancestry.

2.1.5. Conclusions

Collectively, the hardware, autopsy cuts, context of the remains, and associated material artifacts suggest the remains were likely a historic anatomical or medical specimen [4,7,8]. The anthropology report concluded that the remains were not of modern medicolegal significance but noted that the taphonomy and evidence of perimortem trauma were not consistent with common, commercially prepared anatomical specimens.

2.2. Historical Investigation

The historic nature of the medical paraphernalia piqued the medicolegal team's curiosity about their uses for various ailments in the late 1800s, as well as the roles of physicians in the rural Midwest U.S. at that time. Consequently, internet searches were conducted to further investigate the historic material artifacts and Dr. G.B. Ward's past, aimed at learning general information about historic medicine. Unexpectedly, the searches led to over 40 Waterloo Daily Courier newspaper articles from 1894 and 1895 that described Dr. Ward's involvement in an 1895 homicide trial, which provided direct insight into the context and identity of the skull found in Dr. Ward's bag. Here, we provide a summary of the case as presented in the newspaper articles.

2.2.1. G.B. Ward

G.B. Ward was born in Iowa in 1856 and was a practicing physician and surgeon in Fairbank, Iowa, and the surrounding area from 1880 to 1923. He graduated from the University of Michigan, School of Medicine in 1880 and completed postgraduate work in surgery in 1889–1890. He was considered one of Iowa's pioneers in surgical operations, with one article suggesting he was the first surgeon in eastern Iowa to perform an appendectomy [15].

2.2.2. State of Iowa v. Charles Adams (1895)—Black Hawk County

On the morning of 11 November, 1894, Stephen Howard, who turned 70 that day, was allegedly struck by his nephew, Charles Adams, over a dispute regarding Adam's right to drive his cattle along Howard's property to obtain access to water [16]. Howard's wife and daughter said that he returned home, face bleeding, and unable to speak beyond the words "They done it" [17] (p. 14). Dr. Ward and a fellow physician, Dr. Weir, were called to Mr. Howard's residence where they dressed his wounds and established that Howard had suffered a stroke from his injuries, which had rendered him aphasic. Despite their efforts, Howard died from his injuries in the early morning of 14 November, 1894 [18].

Charles Adams was indicted on charges of first-degree murder on 16 January 1895 [19]. In fear of lynchers, Adams surrendered himself [20]. After a continuance, the trial began on 13 March 1895 [21]. The trial lasted more than two weeks, cost the county USD 1426, and required an additional 40 folding chairs to accommodate the large audience [16].

During the trial, Adams admitted to striking Howard multiple times with a club but claimed he acted in self-defense. He testified that Howard approached him mad about the cattle and, as the argument escalated, Howard grabbed a milk stool and began advancing towards him. Adams said he retreated towards the fence grabbing a "club" along the way, and when he was positioned against the fence with Howard still advancing, he struck Howard with the club multiple times until he fell to the ground [22]. The state argued that this was not a case of self-defense, and that Adams used a pitchfork to puncture Howard's face, prying his "upper jaw" (maxillae) from his face.

Various witnesses were called to testify; some suggested they witnessed the event (before being discredited), some indicated they saw blood on the pitchfork (although on the handle), others indicated there was blood on a club (three different potential "clubs" were brought in). The line of questioning was detailed and similar to what you would expect in a present-day courtroom. For example, the Defense asked the Sheriff if he was a "practical chemist" and if he could swear that the blood stains were human [23]. Character witnesses were called on behalf of both the decedent and defendant, and they outlined their history of quarrels, observed demeanors, and even their physical aptitude [24–26]. Of note, however, were the detailed physician testimonies, the length of which bored the audience, who complained that "they were not getting their money's worth" [27] (p. 5). The roles and reported opinions of the doctors are summarized below.

At the time of Howard's death, Drs. Ward and Weir noted "a fracture of the skull starting from near the right ear and running around the back of the head and ending near the left ear" and a second fracture that "started from this larger one near the right ear and extended up onto the head some distance" [18] (p. 3). Dr. Ward described soft tissue "holes" or "punctures" to the cheek, several tooth fractures, an "incision" near the left cheek bone, and "gashes" or "incisions" to the chin [18]. Dr. Ward also described defects to the top of Howard's bald head that he believed could have been caused by the same instrument as the other "incisions," but noted specifically that this injury did not penetrate the bone [18] (Figure 8). Finally, Dr. Ward noted that the upper jaw was fractured in such a way that the "pieces of the jaw could be moved back and forth" [18] (p. 3).

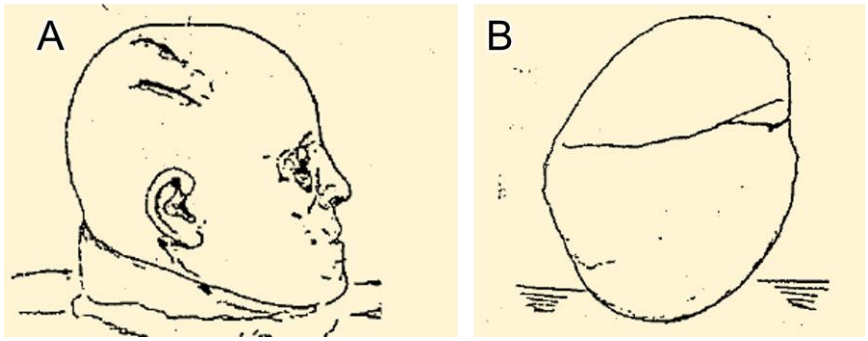

Figure 8. Waterloo Daily Courier stenographic reproduction of (**A**) the injuries to Mr. Howard and (**B**) the fracture to the superior cranial vault as noted during the postmortem evaluation. Stenographic images from "Most Ghastly Evidence" [28] (p. 5).

While a 15 November article refers only to a club as a potential weapon [21], the 16 November article introduces the possibility of a pitchfork given the injuries. It states that in the "opinion of the officers the wounds which penetrated the face of Mr. Howard must have been made by some sharp instrument, probably with the tines of the fork" [18] (p. 3). The "officers", presumably the officers of the law, did not believe a club alone could have created the injuries that they witnessed and Drs. Ward and Weir described. During a preliminary hearing on 8 December, Dr. Weir affirmed that he believed the "punctures" to Howard's face could not have been made by the same instrument as the wounds on the vault [29], which led Drs. Weir and Ward to some further assessments of the trauma.

A second postmortem examination of the head was conducted by the doctors on 21 December. Statements made by the Defense during the trial refer to the remains having been "buried for something like five weeks," implying that the body was exhumed in December for this postmortem assessment [27] (p. 5). During this examination, a "flexible" metal probe was inserted into the injuries to follow their course. It was noted that a probe inserted into the puncture of the cheek passed into the orbital cavity. Dr. Ward then placed the fleshed head (minus the calotte) in some undisclosed type of preservation fluid [27,30].

On 4 February 1895, Dr. Ward conducted several experiments on the head during which he placed the tines of a pitchfork into the cheek and chin, replicating what he believed happened. These experiments were conducted at the photograph gallery, and ten photographs illustrating these experiments were presented as evidence in court [27,28]. The photographs could not be located during our investigation, but stenographic drawings of some of the photos were provided in the newspaper articles (Figure 9). As Dr. Ward later testified, he believed the tines of the pitchfork punctured the right cheek and submandibular region, and then, the fork was twisted in such a manner to produce the facial fractures and pry the maxilla from the face.

Figure 9. Waterloo Daily Courier stenographic reproduction of photographs presented in the 1895 trial as evidence of the experiments conducted by Dr. Ward. Stenographic images from "Most Ghastly Evidence" [28] (p. 5).

Then, on 6 March 1895, Drs. Ward and Weir dissected the tissues of the face to discover the depth of the wounds and assess the skeletal trauma. They noted that the bones of the

face were fractured and driven, in part, into the nasal cavity. They also noted "tracks" deep to the soft tissue delineated by blood clotting, which were interpreted as soft tissue damage from the tines running deep to the skin [31]. They testified that this dissection revealed a "fracture line parallel to the upper teeth and also a line of fracture at the top of the nose and through the orbit of the eyes" [32] (p. 5). Testimony also refers to fractures of the right malar region and orbit of the eye [31,33]. Dr. Ward believed and testified that the heel of the pitchfork was used to knock Howard to the ground, causing the fracture to the neurocranium, while all of the facial fractures were the result of punctures and prying with the pitchfork tines [25,32].

Following the 6 March dissection, the skull was retained by Dr. Ward. He was subpoenaed to bring it with him to court, drawing a large crowd who wanted to see the "ghastly" specimen. Dr. Ward used the skull to demonstrate the fractures and his opinion on the mechanism of injury [28].

The Defense brought in another physician, Dr. Crouse, as an expert witness. Dr. Crouse argued that the injuries described by Dr. Ward were more consistent with a club than the tines of the pitchfork [16,33]. The lawyers referred specifically to a club between 1.5 to 2 inches in diameter. Dr. Crouse explained how blunt impacts could create soft tissue lacerations that mimic puncture wounds and sharp force injuries. His testimony also mentioned the possibility of "contrecoup fractures" in the context of a blow to the top of the head resulting in the observed orbital fractures [33].

On 1 April 1895, the case was turned over to the jury, and after about three hours of deliberation, they found Charles Adams guilty of manslaughter [34,35]. He was sentenced to four years of "hard labor" at the state penitentiary. Despite the trial emphasis on the injury mechanism (club vs. pitchfork), the jurors said it did not weigh heavily in their decision. Instead, they based their guilty verdict on the belief that Adams could have easily escaped the advances made by Mr. Howard, which invalidated the self-defense plea. While incarcerated, a tornado destroyed Adam's barn forcing a foreclosure of the property [36]. With this loss, Adams and those that knew him petitioned for his release. The Governor pardoned Adams in September of 1897, citing the petition, recommendations of the presiding judge and county attorney, and reports of his exemplary behavior at the penitentiary. Adams reportedly moved back to the city looking to lease his old farm [37].

A limited number of records still available at the Black Hawk County Clerk of Court were also reviewed and were consistent with the newspaper accounts. Much of the records were reportedly purged, as was procedure after pardons.

3. Discussion

3.1. Identification

Given the contextual information and the historical documentation, the remains were circumstantially identified as those of Stephen Howard. The fractures on the retained skull match the stenographic drawings of the calotte presented in the trial (Figures 6 and 8), and the skeletal trauma described in Dr. Ward's testimony. The cuts to the occipital condyles, sectioning of the calotte, green staining, and remnant soft tissue are consistent with the events described in the newspaper reports (Figure 10). Dr. Ward's possession of the skull and associated artifacts further supported the identification. The District Court wrote out a receipt to Dr. Ward on 6 August 1895, giving him possession of the "Scull [sic] of Stephen Howard," presumably for educational purposes. It is possible that some of the taphonomic modifications to the skull (e.g., cuts and circular defects) may have occurred sometime after the trial in other experimental efforts or for anatomical exploration.

Historical records (including published obituaries) were used to create a family tree of Mr. Howard's descendants, and a living relative was contacted and informed of the case and remains. They granted approval of this case study. Dr. Ward's living descendants similarly provided approval for this research and publication.

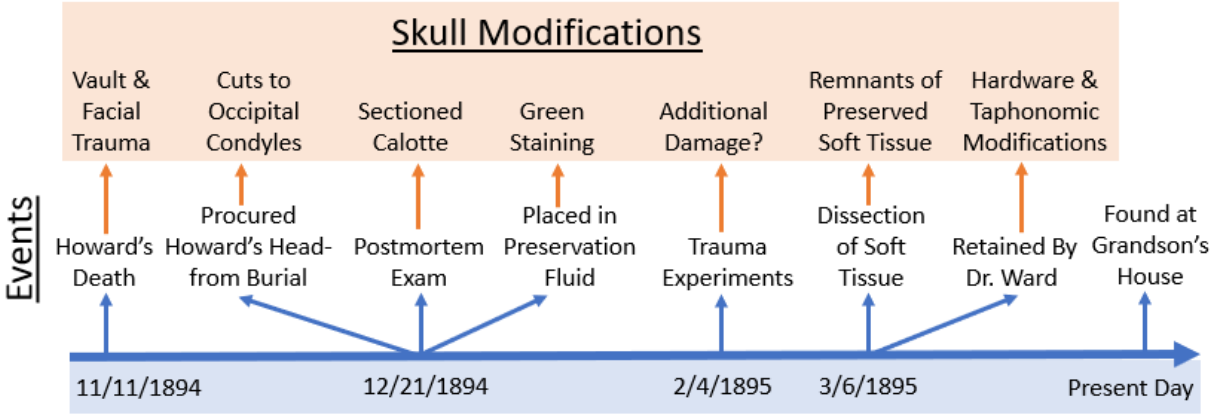

Figure 10. Timeline of events involving Howard's head matched with the associated skull modifications (orange rectangle) observed in the present-day case.

This case study highlights the importance of investigative and forensic anthropological efforts in all cases and cautions against cursory designations of skeletal remains as medical specimens. This case was unique; most anatomical or historical specimens do not have 40 newspaper articles citing their procurement and identity. In fact, without the labeled physician's bag and the dated documents within the bag, an association with the newspaper records would have been unlikely. Context was key in this identification. In some cases, historical investigations may provide clues to the identity; in other cases, the only chance of identification may be investigative genetic genealogy, which has its own set of limitations and may still not lead to an identification [38,39]. Still, it is important to remember that every human bone encountered has an identity.

3.2. Historical Precedence

The detailed case documentation presents a rare glimpse into the legal proceedings in the rural U.S. during the late 19th century. This study also presents an early U.S. case in which human skeletal remains were procured postmortem after burial, experimented on, dissected, and physically presented as evidence in a homicide trial. This case occurred prior to the formal establishment of the field of forensic anthropology, and at a time when other cases were gaining attention for their use of skeletal interpretations in trials. The 1850 Parkman–Webster and 1897 Luetgert trials are commonly referenced in the anthropological literature as catalysts to the development of the field of forensic anthropology [1]. In both homicide trials, expert witness testimony was provided to identify highly fragmented remains as human. The 1893 Lizzie Borden case also occurred just a few years prior to Ward's testimony, during which Dr. William Dolan presented a plaster cast of Andrew Borden's skull as evidence in the homicide trial to illustrate the trauma [40].

Although Dr. Ward was a physician, he essentially presented a forensic anthropological trauma analysis of the remains, including empirical testing with a potential tool. Inserting a suspected tool into an injury or defect is recognized as poor practice by contemporary forensic standards given the potential to further alter the specimen. In truth, it is impossible to determine whether Dr. Ward's experiments (conducted prior to defleshing the skull) could have produced additional damage, particularly to the more fragile bones of the face. However, given the historical time period, the forensic efforts undertaken in this case are commendable. When the experiments were first mentioned on the stand, the Defense objected, saying it was "incompetent and not proper subject for expert testimony" [27] (p. 5). The judge first agreed, saying it was "a little beyond the line", but allowed the line of questioning to continue after the Prosecution cited "authorities" to show that such testimony was admissible (p. 5). It is also noteworthy that Dr. Ward had exhumed Mr. Howard's body to procure the head as evidence. The fluid in which the head was preserved was not revealed, but Brenner [41] notes that late 19th century embalming involved a wide array of chemical combinations, including arsenic, creosote, mercury, turpentine, and

various forms of alcohol. A dissection was then conducted to remove the soft tissues and examine the skeletal trauma. Even today, such skeletal analyses are not always performed when the body is relatively fresh; although as the role of forensic anthropologists has expanded, the use of their expertise on fresh bodies with skeletal trauma has become more common [42].

3.3. Mechanism of Trauma

Stephen Howard's skull did not display any evidence to suggest the trauma was created via punctures with pitchfork tines nor subsequent twisting/prying of the fork as suggested by Dr. Ward and the Prosecution. There were no clear punctures to the bone, no localized areas of fractures where tines would have impacted, nor plastic deformation to the alveolar fracture margins to indicate a prying action. The perimortem fractures to the skull were consistent with at least two blunt force impacts: a minimum of one to the right side of the cranial vault and a minimum of one to the right craniofacial region.

The transmaxillary fracture resulting in complete separation of the maxillary alveolus, commonly referred to as a Le Fort fracture, is typically caused by a blunt force impact(s) to the face [43]. Le Fort fractures were not defined until 1901, six years after the Adams trial [43,44]; thus, Dr. Ward was likely unaware that impacts to the face could result in this degree of alveolar separation, leading him to believe that the maxillae had been pried from the face. Testifying for the defense, Dr. Crouse correctly noted that such fractures could be created by blunt impacts, including those of a club. Dr. Crouse's reference to contrecoup fractures, however, is confusing. It is referenced in the context of a blow to the top of the head creating orbital fractures, yet there are no fractures to the orbital plate in the anterior cranial fossa. The definition of contrecoup fractures dates back as far as Hippocrates [45]. Still, references to contrecoup fractures in the literature were only occasional throughout the 19th century [46]; thus, physicians in 1895 may have had limited exposure to the term. In fact, Allen and Cantab put forth an article in 1896 in the *Brain Medical Journal* [47] about the controversy surrounding the contrecoup mechanism of injury, reflecting the novelty and lack of full comprehension on the subject. It is also important to consider that dissemination and accessibility to resources was more difficult in the 19th century. Physicians also had to take on multiple diverse roles, from attending to minor ailments to performing surgeries, and in this case, that included postmortem examinations as well.

Overall, the pattern of trauma on the skull appears more consistent with the Defense's claim of injury from multiple impacts of a club than the Prosecution's pitchfork theory. The use of a club was initially reported in the preliminary hearing transcripts, and it is what Adams himself confessed to using. The pitchfork theory appears to have arisen to explain what was interpreted as punctures and incisions to the soft tissues and the separation of the maxillary alveolus. It is likely that the maxillary fracture represents a Le Fort fracture from a blunt force impact and the lacerations were misinterpreted as incisions. Lacerations have been noted to mimic sharp force injuries, and methods for differentiating between the two are commonly discussed in contemporary medical and forensic curricula [48].

4. Impact Statement

In this study, a forensic anthropological analysis and historical investigation of a skull found in an antiquated physician's bag led to the discovery of extensive documentation of an 1895 murder trial in the rural Midwest of the U.S., in which the skull was produced at trial as evidence and became the focus of a debate regarding the mechanism of injury. This is amongst some of the earliest and most extensive documentations of the use of skeletal remains in the U.S. courts, and documents pioneering efforts in skeletal trauma analysis prior to the formal development of forensic anthropology. It also illustrates some of the major advances in skeletal trauma analysis over the last century. This case provides unique insight into a historic, rural medicolegal system and court. It highlights the importance of investigative work, the potential to identify non-forensically significant remains, and the need to exert caution when cursorily designating remains as medical specimens.

Author Contributions: Conceptualization, H.G. and L.H.; formal analysis, H.G. and A.V.; investigation, H.G., L.H. and A.W.; resources, H.G. and A.W.; data curation, H.G.; writing—original draft preparation, L.H. and H.G.; writing—review and editing, H.G., A.W. and A.V.; visualization, H.G. and A.V.; supervision, H.G.; project administration, H.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We would like to thank Joan Hanlon, Investigative Genetic Genealogist with UnitedDataConnect for her assistance in building the family trees and locating descendants. We would also like to extend our sincere thanks to the Howard and Ward descendants for granting permission to this case study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Ubelaker, D.H. A history of forensic anthropology. *Am. J. Phys. Anthropol.* **2018**, *165*, 915–923. [CrossRef] [PubMed]
2. Symes, S.A. Morphology of Saw Marks in Human Bone: Identification of Class Characteristics. Ph.D. Dissertation, University of Tennessee, Knoxville, Tennessee, 1992.
3. Symes, S.A.; Chapman, M.S.; Rainwater, C.W.; Cabo, L.L.; Muster, S.M.T. *Knife and Saw Tool-Mark Analysis on Bone: A Manual Designed for the Examination of Criminal Mutilation and Dismemberment*; National Institute of Justice Report: Washington, DC, USA, 2010.
4. Paolello, J.M.; Klales, A.R. Contemporary cultural alterations to bone. In *Manual of Forensic Taphonomy*; Pokines, J., Symes, S.A., Eds.; CRC Press: Boca Raton, FL, USA, 2013; pp. 181–199.
5. Tank, P.W. *Grants Dissector*, 13th ed.; Lippincott Williams & Wilkins: Baltimore, MD, USA, 2005; pp. 208–209.
6. Keleman, G. Removal of the petrous bone from the cranial base for macro- and microscopic investigation: Historical and technical considerations. *Ann. Otol. Rhinol.* **1952**, *61*, 457–464. [CrossRef] [PubMed]
7. Pokines, J.T. Taphonomic characteristics of former anatomical teaching specimens received at a Medical Examiner's Office. *J. Forensic. Identif.* **2015**, *65*, 173–195.
8. Pokines, J.T.; Appel, N.; Pollock, C.; Eck, C.J.; Maki, A.G.; Joseph, A.S.; Cadwell, L.; Young, C.D. Anatomical Taphonomy at the source: Alterations to a sample of 84 teaching skulls at a medical school. *J. Forensic. Identif.* **2017**, *67*, 600–632.
9. Galloway, A.; Zephro, L.; Wedel, V.L. Diagnostic criteria for the determination of timing and fracture mechanism. In *Broken Bones: Anthropological Analysis of Blunt Force Trauma*, 2nd ed.; Wedel, V.L., Galloway, A., Charles, C., Eds.; Thomas: Springfield, IL, USA, 2014; pp. 47–58.
10. Meindl, R.S.; Lovejoy, C.O. Ectocranial suture closure: A revised method for the determination of skeletal age at death based on the latera-anterior sutures. *Am. J. Phys. Anthropol.* **1985**, *68*, 57–66. [CrossRef] [PubMed]
11. Shirley, J.; Jantz, R.B. Spheno-occipital synchondrosis fusion in modern Americans. *J. Forensic. Sci.* **2011**, *56*, 580–585. [CrossRef] [PubMed]
12. Walker, P.L. Sexing skulls using discriminant function analysis of visually assessed traits. *Am. J. Phys. Anthropol.* **2008**, *136*, 36–50. [CrossRef] [PubMed]
13. Hefner, J.T. Cranial nonmetric variation and estimating ancestry. *J. Forensic. Sci.* **2009**, *54*, 985–995. [CrossRef] [PubMed]
14. Coelho, J.; Navega, D. hefneR. Available online: https://osteomics.com/hefneR/ (accessed on 3 December 2020).
15. Thompson, L. Ward Family Has Served Medical Needs of Fairbank for 100 Years. *Waterloo Sunday Courier*. 29 September 1946, p. 14. Available online: https://waterloo.newspaperarchive.com (accessed on 3 March 2020).
16. Was He Quarrelsome? *Waterloo Daily Courier*. 25 March 1895, p. 5. Available online: https://waterloo.newspaperarchive.com/crime-clipping-mar-25-1895-1579768/ (accessed on 4 March 2020).
17. The Way It Was Done. *Waterloo Daily Courier*. 6 December 1894, p. 3. Available online: https://waterloo.newspaperarchive.com/crime-clipping-dec-06-1894-1579646/ (accessed on 4 March 2020).
18. The Howard Murder. *Waterloo Daily Courier*. 16 November 1894, p. 3. Available online: https://newspaperarchive.com/waterloo-daily-courier-nov-16-1894-p-3/ (accessed on 4 March 2020).
19. Charged with Murder. *Waterloo Daily Courier*. 16 January 1895, p. 4. Available online: https://newspaperarchive.com/waterloo-daily-courier-jan-16-1895-p-4/ (accessed on 4 March 2020).
20. Afraid of Lynchers. *Waterloo Daily Courier*. 15 November 1894, p. 3. Available online: https://waterloo.newspaperarchive.com/crime-clipping-nov-15-1894-1579623/ (accessed on 4 March 2020).
21. The Jury Empanelled. *Waterloo Daily Courier*. 13 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-13-1895-p-5/ (accessed on 4 March 2020).

22. Adams Tells His Story. *Waterloo Daily Courier*. 27 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-27-1895-p-5/ (accessed on 4 March 2020).
23. He Made Them Laugh. *Waterloo Daily Courier*. 15 March 1895, p. 5. Available online: https://waterloo.newspaperarchive.com/crime-clipping-mar-15-1895-1579733/ (accessed on 4 March 2020).
24. Experts are Ruled Out. *Waterloo Daily Courier*. 28 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-28-1895-p-5/ (accessed on 4 March 2020).
25. A Struggle of Giants. *Waterloo Daily Courier*. 19 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-29-1895-p-5/ (accessed on 4 March 2020).
26. Goes to Jury Monday. *Waterloo Daily Courier*. 30 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-30-1895-p-5/ (accessed on 4 March 2020).
27. The Pitchfork Theory. *Waterloo Daily Courier*. 16 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-16-1895-p-5/ (accessed on 4 March 2020).
28. Most Ghastly Evidence. *Waterloo Daily Courier*. 18 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-18-1895-p-5/ (accessed on 4 March 2020).
29. Says Del Swore False. *Waterloo Daily Courier*. 8 December 1894, p. 5. Available online: https://waterloo.newspaperarchive.com/crime-clipping-dec-08-1894-1579655/ (accessed on 4 March 2020).
30. Will Be Tried. *Waterloo Daily Courier*. 4 February 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-feb-04-1895-p-5/ (accessed on 4 March 2020).
31. State Rests Its Case. *Waterloo Daily Courier*. 20 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-20-1895-p-5/ (accessed on 4 March 2020).
32. Might Have Been a Club. *Waterloo Daily Courier*. 19 March 1895, p. 5. Available online: https://waterloo.newspaperarchive.com/crime-clipping-mar-19-1895-1579751/ (accessed on 4 March 2020).
33. Doctor Versus Doctor. *Waterloo Daily Courier*. 21 March 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-mar-21-1895-p-5/ (accessed on 4 March 2020).
34. What Will the Jury Do? *Waterloo Daily Courier*. 1 April 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-apr-01-1895-p-5/ (accessed on 4 March 2020).
35. It Was Manslaughter. *Waterloo Daily Courier*. 2 April 1895, p. 5. Available online: https://newspaperarchive.com/waterloo-daily-courier-apr-02-1895-p-5/ (accessed on 4 March 2020).
36. Applied for Pardon. *Waterloo Daily Courier*. 3 August 1895, p. 5. Available online: https://waterloo.newspaperarchive.com/crime-clipping-aug-03-1895-1579811/ (accessed on 4 March 2020).
37. Wants to Come Back. *Waterloo Daily Courier*. 28 September 1897, p. 4. Available online: https://waterloo.newspaperarchive.com/crime-clipping-sep-28-1897-1579834/ (accessed on 4 March 2020).
38. Kling, D.; Phillips, C.; Kennett, D.; Tillmar, A. Investigative genetic geneology: Current methods, knowledge and practice. *Forensic. Sci. Int.* **2021**, *52*, 102474. [CrossRef] [PubMed]
39. Fitzpatrick, C. The emerging discipline of forensic genetic genealogy. In *Forensic Genetic Approaches for Identification of Human Skeletal Remains: Challenges, Best Practices, and Emerging Technologies*, 1st ed.; Ambers, A., Ed.; Academic Press: Cambridge, MA, USA, 2022; pp. 459–488.
40. Widdows, H. Lizzie Andrew Borden Virtual Museum and Library Primary Source Documents, Trial Transcript Vol. 1. 2001. Available online: https://lizzieandrewborden.com/primary-source-documents-borden-case.htm (accessed on 25 January 2023).
41. Brenner, E. Human body preservation—Old and new techniques. *J. Anat.* **2014**, *224*, 316–344. [CrossRef] [PubMed]
42. Crowder, C.M.; Wiersema, J.M.; Adams, B.J.; Austin, D.E.; Love, J.C. The utility of forensic anthropology in the Medical Examiner's Office. *Acad. Forensic Pathol.* **2016**, *6*, 349–360. [CrossRef] [PubMed]
43. Phillips, B.J.; Turco, L.M. Le Fort fractures: A collective review. *Bull. Emerg. Trauma* **2017**, *5*, 221–230. [CrossRef] [PubMed]
44. Galloway, A.; Wedel, V.L. Bones of the skull, the dentition, and osseous structures of the throat. In *Broken Bones: Anthropological Analysis of Blunt Force Trauma*, 2nd ed.; Wedel, V.L., Galloway, A., Charles, C., Eds.; Thomas: Springfield, IL, USA, 2014; pp. 133–160.
45. Rose, F.C. The history of head injuries: An overview. *J. His. Neurosci.* **1997**, *6*, 154–180. [CrossRef] [PubMed]
46. Payne, W.N.; De Jesus, O.; Payne, A.N. *Countrecoup Brain Injury*; StatPearls Publishing, LLC.: Treasure Island, FL, USA, 2022. Available online: https://www.ncbi.nlm.nih.gov/books/NBK536965/#_NBK536965_pubdet_ (accessed on 28 February 2023).
47. Allen, F.J. The mechanism of contre-coup and of certain other forms of intracranial injury. *Br. Med. J.* **1896**, *1*, 1196–1197. [CrossRef] [PubMed]
48. DiMaio, V.J.; DiMaio, D. *Forensic Pathology: Practical Aspects of Criminal and Forensic Investigations*, 2nd ed.; CRC Press: Boca Raton, FL, USA, 2001; pp. 104–106.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.