Famous head injuries of the first aerial war: deaths of the “Knights of the Air”

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World War I advanced the development of aviation from the concept of flight to the use of aircraft on the battlefield. Fighter planes advanced technologically as the war progressed. Fighter pilot aces Francesco Baracca and Manfred von Richthofen (the Red Baron) were two of the most famous pilots of this time period. These courageous fighter aces skillfully maneuvered their SPAD and Albatros planes, respectively, while battling enemies and scoring aerial victories that contributed to the course of the war. The media thrilled the public with their depictions of the heroic feats of fighter pilots such as Baracca and the Red Baron. Despite their aerial prowess, both pilots would eventually be shot down in combat. Although the accounts of their deaths are debated, it is undeniable that both were victims of traumatic head injury.

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“**A**FTER so much experience, after so many examples, there are still people who discuss the possibility of surprise in air combat,” commented Silvio Scaroni, an Italian World War I fighter pilot, years later about the air duels on May 10, 1917, near the 10th Battle of the Isonzo.^{9,13,22} He was referring to the surprises that Francesco Baracca met with that day: two Austrian fighter pilots, Godwin Brumowski and Rudolf Stöhr.¹³ Baracca’s report of the event is typical of an aerial duel in World War I.^{13,22} He reports seeing two enemy airplanes; flying 500 m above them at an elevation of 4200 m, he then “dove on the first one” and shot “a burst of 60 rounds” from his gun, causing the plane to crash.¹³ Right after this, the second plane “fired a quick burst” close to Baracca and passed “200 meters over” Baracca’s fighter plane’s left wing. This enemy, Rudolf Stöhr, managed “to fire just twenty rounds,” hitting Baracca’s plane and “just missing the rudder cable.”

Background

The spark for World War I came about with the assassination of Archduke Franz Ferdinand and his wife Sophie in Sarajevo on June 28, 1914.^{6,25} The war lasted from 1914 to 1918, mobilizing 60 million men, of whom 7 million were killed and more than 19 million were wounded.^{10,11,25}

World War I was unique for its time, with features unseen in any previous war. One feature was the development of aviation for warfare, including Zeppelins (German airships created by Count Zeppelin), observation balloons, and various aircraft: fighters, reconnaissance, and bombers.^{9,13,17} Initially, there were international efforts in enacting “general peace and a possible reduction of excessive armaments” through the two Hague conventions in 1899 and 1907 (see <http://www.cfr.org/international-law/hague-conventions-1899-1907/p9597>).¹⁷ However, countries like Germany and France still led research and development of different aircraft such as the German Fokker and French SPAD fighter planes.²⁷

With these and other new military developments, such as trench warfare, came a variety of injuries that military physicians, surgeons, and nurses were unfamiliar treating: multiple injuries from blunt trauma, lacerations, and different degrees of skull penetration from fragments of artillery.¹⁹ This paper reviews the life and death of two famous aerial aces who were greatly influential not only as warriors but as symbols of each nation’s success. Through their lives, their feats, and their untimely deaths, they filled their fellow citizens with nationalistic pride, and their nations collectively mourned the loss of these “knights of the air.”

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Francesco Baracca

Early Life and Military Training

Francesco Baracca (Fig. 1) was born on May 9, 1888, in Lugo di Romagna to Enrico Baracca and Paolina Biancoli.¹³ Enrico was a wealthy landowner and businessman, and Paolina was a countess. Francesco was the only child of his parents and went to elementary school in Lugo and to the Scolopi della Badia Fiesolana middle school in Florence.^{13,22} In 1907, he received a diploma in Classical Studies at the Dante di Firenze Lyceum in Florence.^{9,22} Despite having the luxury of carrying on the family business, he decided to pursue a career in the military.^{13,22} As a result, he enrolled in the Scuola Militare, a military school in Modena, where he was trained to serve in the cavalry.^{9,12} In 1909 he enrolled into the Piemonte Reale Cavalry.^{9,22} He wanted to fight in Libya during the Italo-Turkish War, and even asked his father for help to facilitate this, but was not given permission to participate.^{14,20,22,28}

Despite not being able to fight in the Italo-Turkish War, Baracca received the opportunity to learn aviation in Rheims starting in April 1912. He obtained his Italian Sport License on July 9, 1912, and later his Italian Military Pilot License on December 8, 1912.^{9,13,20,22} After receiving his licenses he participated in raids between locations such as the Malpensa airfield and Asti.^{20,22} He was promoted to Lieutenant at Malpensa, and then moved to the Taliedo airfield in 1913. He later demonstrated the usefulness of planes in warfare by performing reconnaissance trials at the Busto Arsizio airfield.

Wartime Participation and Victories

On May 24, 1915, Italy joined the Allied forces and officially declared war against the Central Powers—Germany and the Austro-Hungarian Empire.^{9,29} Around this time, the Italian Aeronautics Administration sent pilots, including Baracca, to Le Bourget in France to gain more expertise in aviation.^{20,22,29}

By the end of July, Francesco Baracca was assigned to the 8^a Squadriglia that used the French-branded “Nieuport biplanes” (Fig. 2).²⁹ One of his first missions was to defend the city of Udine and the Italian Supreme Command from an Austrian air raid.^{13,20,22} The Italian military adopted different numbering systems for their squadrons because of the advances in aircraft technology and the emerging roles of different aircraft.⁹ As a result, the 8^a Squadriglia was renamed the 1^a Squadriglia da Caccia (Hunter/Attack Squadron) on December 1, 1915.^{9,13,29}

On April 7, 1916, the rising star Baracca scored not only his first aerial victory when he shot down an Austrian plane over Medeuza, but also the first aerial victory for the Italian airforce.^{9,13,20,22,29} The 1^a Squadriglia was renamed the 70^a Squadriglia Caccia shortly after, on April 15, 1916.^{9,13,29} He earned his 5th victory, defining him as an “Asso” (Ace) while defending Udine by shooting down the Brandenburg C.1 27.74 plane of Korp. Ludwig Fleck and Lt. Wilhelm Graf Siemenski in front of the King and the citizens of Udine. This success established Baracca as the skilled pilot that the Italians would grow to admire.^{13,29}

On May 1, 1917, the 70^a Squadriglia was renamed the 91^a Squadriglia.^{9,13,29} By this time, Baracca had adopted

FIG. 1. Francesco Baracca (1888–1918). Public domain: http://it.wikipedia.org/wiki/File:FRANCESCO_BARACCA.jpg.

an insignia of a black prancing horse on his new SPAD 7 (Fig. 3) to honor his start with the Piemonte Reale Cavalry, which featured a silver horse on a red background.^{9,29} He used this new plane to score a victory at the 10th Battle of the Isonzo, one of many battles against the Austrians.^{9,13} He was promoted to the rank of Major by December 1917, the highest promotion among the ranks of Italian Army officers, only 5 years into his aviation career.¹³

Baracca temporarily took leave of the 91^a Squadriglia to test new fighter plane models in Turin, and returned on January 24, 1918.^{13,22} In the beginning of 1918, Germany concentrated its efforts on the Western Front to fight France and Britain. This left Austria on its own to face the growing Italian Front.^{13,29} With increasing numbers of aviation squadrons and skillful pilots such as Baracca, Italy was prepared to face Austria during one of the final offensives initiated by Austria on the Piave River.^{13,20,22,29} He scored his 33rd and 34th victories during this offensive on June 15, 1918, with his SPAD 13 plane, just several days before his death.^{13,20,22}

Personality

Francesco Baracca was and is still considered the “ace

FIG. 2. Francesco Baracca in the cockpit of his Nieuport plane. Public domain: http://commons.wikimedia.org/wiki/File:Francesco_Baracca_a_rep%C3%BCI%C5%91g%C3%A9p%C3%A9ben.jpg.

of all aces” for Italy in World War I.²² He was a highly skilled and disciplined pilot who had a strong sense of patriotism for his country.^{13,14,20,22} His skill as a fighter pilot is depicted through his various battle reports.¹³ His character extends beyond the realm of military; there are many records of letters he wrote to his mother detailing his battles and comments about the planes and other aspects of his military experience.^{13,15,16} These letters portray the many aspects of his personality; from intelligent, serious, and reserved to friendly, humble, and compassionate.^{13,20,22}

Throughout his participation in World War I, he gained the respect of those around him, from the subordinates he helped to train, to the victims of his aerial battles whom he visited at the hospital, to the wreaths he placed on the battlefield for those less fortunate.^{7,13,20,22} After the ace’s tragic death, even the King of Italy, Victor Emmanuel, sent his condolences to Baracca’s father.¹³

Death

On June 19, 1918, Baracca embarked on a strafing mission with rookie pilot Franco Osnago above the hill Montello.^{9,13,20,22,29} Osnago stayed above the hill and Baracca flew down into the enemy trenches.²⁹ Osnago saw a plane in flames after losing sight of Baracca’s SPAD 7. Believing the burning plane to be Baracca’s, Osnago rushed back to the airfield to notify the squadron that Baracca was gunned down.^{9,13,29} When he and two others, including a journalist, found Baracca’s body on June 24, 1918, 5 days after the crash, they found a bullet hole through his right temple.^{9,13,20,22,29}

To this day, the origin of the bullet that killed Baracca has not been confirmed.^{9,13,20,22,29} One theory is that he was shot down by enemy groundfire by an infantryman, as reported by Osnago.^{9,13,29} Because Baracca’s revolver was found not too far from his body, another theory is that he committed suicide to prevent being taken prisoner by the enemy.^{9,13,14,29} This theory of suicide was used by the press, including an aviation magazine called *Cielo*, which claimed that Baracca had declared he would kill

FIG. 3. Major Francesco Baracca in front of his SPAD 7 with the prancing horse. Public domain: http://commons.wikimedia.org/wiki/File:FBaracca_1.jpg.

himself instead of falling into the hands of the enemy.¹³ However, Baracca was flying at a low elevation close to the trenches and probably did not have the time to escape from his burning plane to commit suicide, undermining this theory. In addition, he fell in an area that may not have been fully occupied by the Austrians because of Italian advancement, undermining the idea that Baracca wanted to avoid being captured by the enemy.

A third theory is that Zugführer Kauer and Oberleutnant Barwig of Flik 28 shot down Baracca from their Austrian Phönix C.1 121.17 plane.^{9,13,29} However, the Italian Supreme Command claimed that it was due to “an unknown enemy infantryman.” This matched the report of Osnago, who also claimed that there were no other planes when he saw the burning SPAD 7 of Baracca.^{13,29}

On June 19, 2013, on the 95th anniversary of Baracca’s death, two researchers from the Istituto per la Storia del Risorgimento Italiano published another theory of the ace’s death after having reviewed all material available during that period of the war. Gambaretto and Callegari report that Baracca’s plane was clearly in a controlled descent during the final minutes of flight.¹² Those who recovered Baracca’s body reported a small “entrance” wound on the medial aspect of the right orbit near the root of the nose. Forensically, the authors agreed that this trajectory would not have been feasible from either an enemy’s airplane bullet or from an infantryman. The entrance wound

was too small to be fired from an enemy's airplane and the ballistic angle could not have been achieved by an infantryman on the ground without striking other parts of Baracca's body. The authors thus concluded that Francesco Baracca died of injuries sustained upon the plane's impact, as his head struck the cockpit's instruments and panel, resulting in an open laceration.

It is difficult to predict how far Baracca would have progressed in his military career had he survived through World War I. However, he no doubt would have continued to excel as the master pilot he had already become and would have been indispensable to the Italian air front. Francesco Baracca lives on in Italian history, among other places, with an entire museum in his native country dedicated to his life, and the characteristic symbol on his plane is immortalized on Ferrari sports cars.^{13,16,29} When Enzo Ferrari met with Baracca's mother, the Countess Paolina Biancoli, she told him to use the prancing horse on his cars since it would bring "good luck."¹⁶ Baracca's prancing horse insignia continues to grace Ferrari vehicles to this day and reminds the world of his fast-paced life, his devotion to military service, and his impact on aviation development in World War I.^{13,16,22,29}

The Red Baron

Rittmeister Manfred Albrecht Freiherr von Richthofen, the Red Baron (Fig. 4), is arguably the most famed and successful aviator in history, with a total of 80 combat victories from 1916 to 1918.^{18,23} His legendary accomplishments have even pervaded popular culture through the "Peanuts" character Snoopy dreaming about defeating the Red Baron.²⁶ Manfred von Richthofen's moniker the "Red Baron" came from painting his aircraft red to distinguish himself in battle.^{18,30} This boldness as well as the sensationalization by the German army helped create his celebrity status.^{18,30} He shot down 80 aircraft and became the most highly decorated German officer before he himself was shot down and killed on Sunday, April 21, 1918, at the age of 25.^{18,23} There has been much controversy over his death, and this has been previously explored by various authors.^{2,18} The top contenders for who shot down the Red Baron are Captain A. R. Brown, a Canadian pilot, and Sergeant Popkin, an Australian machine gunner. However, the focus of this section is not who killed him, but rather how this decorated soldier was finally able to be targeted. Figure 5 shows the Red Baron inspecting a Fokker triplane.

Although he was shot down and died on April 21, 1918 (Fig. 6), it was his injury on July 6, 1917, that began his decline in health.^{2,18,23,30} He describes the incident in his autobiography as feeling a sudden blow to his head, becoming paralyzed and blinded.^{2,30} He never lost consciousness but fought to regain control of his limbs.² By this time his plane had dropped 3200 m and he was able to land.^{2,30} He felt he was going to faint once more but was able to exit the plane, landing on a thistle before losing consciousness.^{2,30} Allmers was able to obtain the Red Baron's full military medical record and reviewed it in detail.² The medical report at the field hospital he was brought to recounts a similar story, and there the initial diagnosis was a "ma-

FIG. 4. Manfred Albrecht Freiherr von Richthofen, the Red Baron. Photo taken by C.J. von Duhren, 1917 (Willi Sanke postcard). Public domain: photos taken before January 1st, 1923, are in the public domain in the US. <http://www.german-way.com/notable-people/featured-bios/manfred-von-richthofen/>.

chine gun [projectile] ricocheting from head." He underwent exploratory surgery to determine that the bullet had not entered his brain. However, his surgeon recorded that he undoubtedly had a "severe concussion of the brain and even more probable a cerebral haemorrhage," thus recommending that he not resume flying until he was given permission by a physician. Medical clearance after head injury at the time was based on primitive criteria, and guidelines were made before wartime. The only requirement was that someone with head injury or malformation would be ineligible for duty if he could not wear appropriate headgear. von Richthofen remained at the field hospital for 20 days, and when he left to resume flying he had an open 2.5 × 2.5-cm skull wound.

After leaving the field hospital on July 25, 1917, he did not fly again until August 18, 1917, when he shot down his 58th plane.² On August 27, 1917, another piece of bone was removed from his skull wound. During his time at the field hospital and convalescing at home, his mother did not note a change in his mood. However, by the end of January 1918, she described him as distant and almost unapproachable—she attributed this to his job and not to his

FIG. 5. von Richthofen (third from the right) inspecting a Fokker triplane with General von Falkenhayn, circa 1918 (Australian War Memorial). Public domain: <https://www.awm.gov.au/collection/C04708/>.

FIG. 6. The remains of the Red Baron's Fokker triplane, April 22, 1918 (Australian War Memorial). Public domain: <https://www.awm.gov.au/collection/E02044/>.

head injury. The Red Baron wrote the first edition of his self-titled autobiography during his time in the field hospital. In the spring of 1918 he added a chapter describing a new depression and melancholy and feeling unwell after air combat.^{2,30} Unlike his mother, who felt these changes were related to his job, Manfred instead attributed them to his head injury.

After the Red Baron was shot down, his autopsy was conducted by four medical officers.⁴ C. E. W. Bean provides abbreviated synopses of their autopsy reports in Appendix No. 4 of Volume V of *The Official History of Australia in the War of 1914–1918*.⁴ In these abbreviated reports there is no mention of his head wound; instead they concentrate on the potential shot that killed him in the context of determining whether the shot came from the air or the ground. In an article in *Sabretache*, Dr. Geoffrey Miller acknowledges the inconsistencies in the autopsy reports from the Appendix and goes to the primary source, called the “Bean Papers.”²¹ He provides curious elements in the documents of the panel of doctors who examined the Red Baron immediately after death and also in those of the second panel of doctors who examined von Richthofen. Colonel T. Sinclair, a consulting surgeon in the first panel of doctors, noted “some minor bruises of the head and face” in his autopsy report but made no mention of a skull wound. Colonel George Barber, Director-General of the Australian Army and Airforce Medical Services, wrote to C. E. W. Bean of his own personal examination, “There was no wound of the head but there was considerable bruising over the right jaw which may have been fractures.” (The underlining was original in Colonel Barber’s handwritten letter.)

Without access to the Red Baron’s medical records, it is difficult to determine the location of the head wound he sustained on July 6, 1917. From reports it would seem he was flying toward his enemy, and he could have sustained a head wound to his frontal lobe.^{2,30} He underwent exploratory surgery after his injury to ensure a bullet had not entered, but had bone fragments within his brain, some of which were removed, with unknown consequences to the underlying tissue and thus potential neurological deficit.² However, his subsequent change in personality from

an enthusiastic, sharp, bold fighter pilot to a withdrawn, dejected man, which he himself attributed to his head wound, is similar to the personality change of those who undergo frontal lobotomies.¹ Studies on the effect of frontal lobotomies and frontal lobe injury suggest that patients become less enthusiastic, have slower reaction times but are more impulsive, lose insight, have difficulty learning, and have an altered time perception.^{1,5,24} All of these elements would have taken a toll on even the most experienced fighter pilot, and may help explain how the Red Baron was able to be shot down.^{4,21} Therefore, although it would be presumptive to say that he died secondary to his brain injury, it may be extrapolated that due to the brain injury he sustained on July 6, 1917, from which he was clearly showing symptoms, his judgment was impaired in a way that may have led to his ultimate demise. Perhaps it was inevitable for a man as prolific as he to eventually be unable to avoid the fate of those he shot down before him, but the shock waves that his death left behind suggest that his demise was premature. It is difficult to predict the course of history if the Red Baron had not been killed. However, from his success and fame, it is clear that his death was a loss not only to the German army for his military prowess but also to the German people for his heroism.

Conclusions

From the tragic flight in the myth of Daedalus and Icarus, to the creation of the first aircraft by inventors like the Wright brothers and Count Zeppelin, World War I gave the world the opportunity to develop and pragmatically use airplanes and dirigibles.^{3,17,27} Fighter pilots like Francesco Baracca and Manfred von Richthofen captivated the world with the skillful maneuvering of their fighter planes. The fast-paced and exhilarating lives of Francesco Baracca and the Red Baron still fascinate the minds of World War I historians as archetypal knights of the air. Their premature deaths saddened their countries and simultaneously invigorated their enemies. Although their exact

causes of death may continue to be debated, the impact that they each had during the war is undeniable. They are and always will be two of the earliest and most infamous cases of aerial combat–related head injury and death in neurotrauma history.

World War I and its many legends of medicine and war will continue to provide ample material for future analysis as we continue to explore its influence on modern neurosurgical practice. The untimely deaths of two heroes of the Great War due to head injury suggest the potential for dramatic impact that such injuries can have on the flow of history.

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