

Vivien T. Thomas, the pioneering lab assistant who revolutionized congenital heart disease surgery

Natalia Ceneda¹, Salvatore Giordano², Giuseppe Biondi-Zoccai^{3,4}, Marco Bernardi¹

¹Department of Clinical, Internal Medicine, Anesthesiology and Cardiovascular Sciences, Sapienza University of Rome, Italy

²Division of Cardiology, Department of Medical and Surgical Sciences, Magna Graecia University, Catanzaro, Italy

³Department of Medical-Surgical Sciences and Biotechnologies, Sapienza University of Rome, Italy

⁴Mediterranea Cardiocentro, Napoli, Italy

Abstract

Tetralogy of Fallot (ToF) is the most common cyanotic congenital heart disease. Patients who have undergone surgical repair of ToF constitute one of the largest groups of congenital heart disease patients surviving into adulthood. The history of ToF surgical techniques has evolved through the years, starting from the early 1930s. In this context, many leading figures are acknowledged as pioneers in cardiothoracic surgery. There is one who has struggled to obtain fair recognition of his work: Vivien T. Thomas. This young Afro-American man, because of his origin and economic possibilities, had to wait more than 30 years before being recognized his pivotal role in the groundbreaking first open-heart pediatric surgery of ToF.

Key words: Vivien Thomas, Tetralogy of Fallot, cardiac surgery, Blalock-Thaussig-Thomas shunt

(Heart Vessels Transplant 2023; 7: 148-50 doi: 10.24969/hvt.2022.387)

Surgical repair of Tetralogy of Fallot (ToF) represented a significant milestone in the field of cardiac surgery. Indeed, ToF is the most common cyanotic congenital heart disease accounting for approximately 7 to 10% of congenital heart defects with an incidence of 3 per 10,000 live births, and nowadays, patients who have undergone surgical repair of ToF constitute one of the largest groups of congenital heart disease patients surviving into adulthood (1)

This congenital cardiac defect consists of four major characteristics:

- 1) overriding aorta
- 2) ventricular septal defect
- 3) pulmonary stenosis and
- 4) right ventricular hypertrophy.

The complexity and variety of clinical manifestations observed in ToF are truly intriguing, and it is remarkable how distinct anatomical features can influence the severity of this congenital heart condition (2). The main characteristic of ToF

lies in the "cyanotic spells", which cause shortness of breath (particularly during exertion), palpitations, and syncope. In addition to the well-known tetrad, hypoplasia of the pulmonary arteries, right aortic arch, and anomalous course of the coronary arteries can coexist, which can be crucial in the choice of corrective surgical strategy. The evolution of ToF surgical techniques is fascinating: the main objective has developed from temporary repair to complete repair surgery. The procedure requires a highly skilled and experienced surgical team and meticulous planning and execution to ensure the best possible outcome for the patient (3).

In this context, while many leading figures were acknowledged as pioneers in cardiothoracic surgery, others have struggled in obtaining fair recognition. In November 1944, the first open-heart surgery on a fifteen-month-old girl named Eileen Saxon affected by ToF, was performed. At the operating table, there was the full Professor of Surgery Alfred Blalock, guided and assisted by Vivien T. Thomas, a young lab assistant who did not even graduate to college but whose ideas and perseverance brought him to take part in this major event for the history of medicine (4).

Address for Correspondence: Marco Bernardi Department of Clinical, Internal Medicine, Anesthesiology and Cardiovascular Sciences, Sapienza University of Rome, Piazzale Aldo Moro 5, Rome, Italy. **Email:** marco.bernardi23@gmail.com; **Twitter:** MarcoBernardiMD; **ORCID:** 0000-0001-9269-8829

Received: 09.05.2023 **Accepted:** 10.05.2023

Copyright ©2023 Heart, Vessels and Transplantation

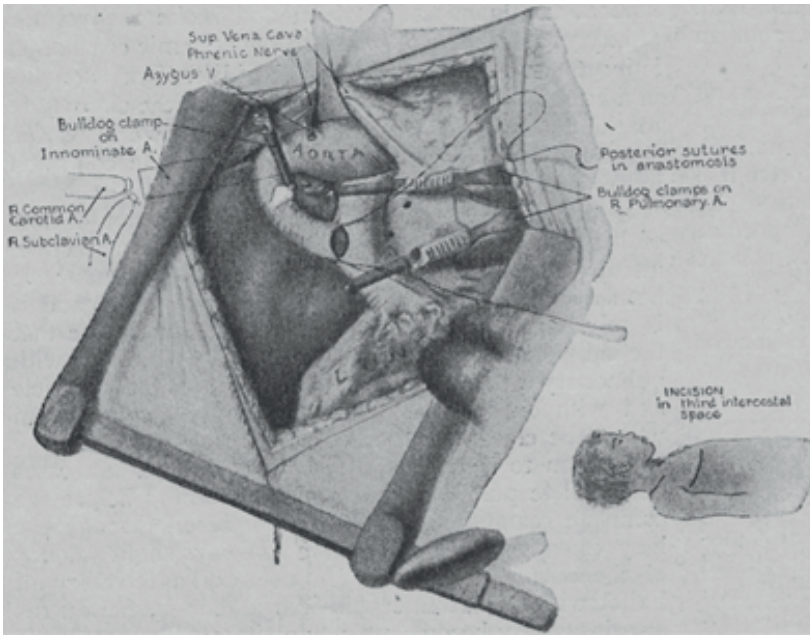


Figure 1. Graphic explanation of the BTT shunt, appeared in the first joint paper of Blalock and Taussig (Published under open access rules <https://www.library.jhu.edu/policies/rights-and-reproductions/> from <https://exhibits.library.jhu.edu/exhibits/show/the-blue-baby-operation>)

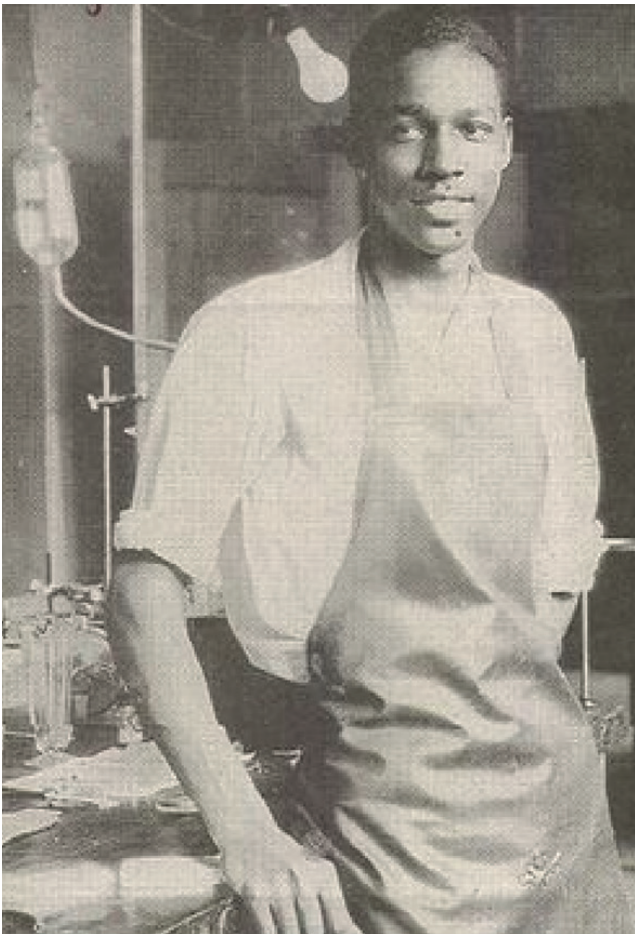


Figure 2. Old picture of Vivien T. Thomas during his early career as a lab assistant (Reproduced under CC_BY_SA 4.0 license from www.wikipedia.org/wiki/Vivien_Thomas)

Coming from a humble family that did not have the possibility to attend college and medical school, Vivien Thomas started approaching scientific experiments in 1930 as he became a surgical research assistant at Vanderbilt University in Nashville and had the opportunity to meet and take part of Blalock's studies on shock (5). It did not take Blalock long to realize that Thomas was essential to his work. Indeed, Thomas's remarkable attitude and quick learning ability allowed him to lead the entire lab and perform several experiments, particularly on animal models. In 1941 Blalock was offered to work as Chief of Surgery and Professor of the Department of Surgery at Johns Hopkins medical school; however, he accepted the position only after Thomas was hired, demonstrating their strong bonding and the lab assistant's crucial role (6).

In the same period Helen B. Taussig, a pediatric cardiologist, was fully dedicated in conducting her studies on infants with cyanotic heart defects and, together with Blalock and Thomas, theorized a possible solution to ToF, consisting in connecting the subclavian artery to the pulmonary artery creating a shunt which enhances pulmonary blood flow by allowing the blood coming from the left ventricle – mixed with deoxygenated blood flow from the ventricular septal defect - to reach the pulmonary circulation and improve the cyanotic state (7). Notably, Vivien Thomas experimented this surgery strategy on several animals, and his work was crucial to enlighten each critical step of the procedure. Because he did not have any recognized professional education, he never realized it on humans; nevertheless, on the day of the first world case of ToF surgery, Blalock strongly desired Thomas to be by his side to guide and advise him (7). The collaboration of these three figures brought to the definition of the Blalock-Thomas-Taussig shunt (BTT shunt), first only named after Blalock and Taussig, overlooking a critical contributor who technically gave structure to this surgical technique (8).

The use of BTT shunt has significantly reduced early mortality. With the advancements in surgical techniques and procedures, it has been used as a "bridge" before undergoing definitive corrective surgery. The principles of the BTT shunt surgery arose from the ability of observing physiologic shunts in the fetal circulation, such as the duct arteriosus and its functioning, leading to the application to congenital cardiac defects such as ToF.

Despite having a pivotal role in the groundbreaking first open-heart pediatric surgery in 1944, it took 32 years for Vivien Thomas to be finally awarded an honorary doctorate by J. Hopkins University. Moreover, he was also bestowed with the title of Instructor of Surgery in recognition of his immense contributions to the field (6,9).

As Giambattista Vico taught us, it is not rare that some patterns repeat throughout history: the acknowledgment of prominent figures such as Vivien Thomas often is concealed by other great names because of discrimination of race, social class, or sex gender and infrequently have the opportunity to, even if after a long time, gain the merit for all to see as in this case. The thought quickly turns to Rosalind Franklin and her

under-recognized fundamental contribution to the resolution of the DNA structure enigma. Another example is Hamilton Haki, a great surgical teacher in the animal surgical lab in Christiaan Barnard team who, because of apartheid laws, was forced to be hired with the official position of a gardener (10). Vivien Thomas' story should serve as a poignant reminder that the scientific community must always acknowledge anyone who has made significant contributions to the advancement of science. His legacy serves as an inspiration for all of us.

Peer-review: Internal

Conflict of interest: Giuseppe Biondi-Zoccai has consulted for Cardionovum, CrannMedical, Innovheart, Meditrial, Opsens Medical, Replycare, Teleflex, and Terumo – this is not related to the content of the article. All other authors report no conflict of interest.

Authorship: N.C., S.G., G.B.-Z., M.B. equally contributed to the preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Braunwald's Heart Disease. A Textbook of Cardiovascular Medicine 12th Edition - October 15, 2021
2. Cuypers JA, Menting ME, Konings EE, Opić P, Utens EM, Helbing WA, et al. Unnatural history of tetralogy of Fallot: prospective follow-up of 40 years after surgical correction. *Circulation* 2014; 130: 1944-53.
3. Diaz-Frias J, Guillaume M. Tetralogy of Fallot. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
4. Thomas V. Partners of the heart: Vivien Thomas and his work with Alfred Blalock. University of Pennsylvania Press; 1985.
5. Toledo-Pereyra LH. Alfred Blalock. Surgeon, educator, and pioneer in shock and cardiac research. *J Invest Surg* 2005; 18: 161-5.
6. Joyner A, Yeo CJ, Maxwell PJ. Vivien Thomas: master craftsman, gifted teacher, and unsung hero. *Am Surg* 2015; 1: 118-20.
7. Arciniegas E, Farooki ZQ, Hakimi M, Perry BL, Green EW. Classic shunting operations for congenital cyanotic heart defects. *J Thorac Cardiovasc Surg* 1982; 84: 88-96.
8. Blalock A, Taussig HB. The surgical treatment of malformations of the heart in which there is pulmonary stenosis or pulmonary atresia. *JAMA* 1984; 251: 2123-38.
9. Soylu E, Athanasiou T, Jarral OA. Vivien Theodore Thomas (1910-1985): An African-American laboratory technician who went on to become an innovator in cardiac surgery. *J Med Biogr* 2017; 25: 106-13.
10. Zühlke L, Mayosi BM. The life and the legacy of Hamilton Naki: Experimental heart transplant surgeon and teacher. *J Heart Lung Transplant* 2017; 36: 1309-10.