



# Cardiothoracic surgery in South Africa: a history

Ivan Schewitz<sup>^</sup>

Department of Cardiothoracic Surgery, University of Pretoria, Pretoria, South Africa

*Correspondence to:* Ivan Schewitz, MBChB, FCS (Cardiothoracic Surgery), Honorary Consultant Pretoria University. Department of Cardiothoracic Surgery, University of Pretoria, Pretoria, South Africa. Email: Ivan@schewitz.com.

**Abstract:** Cardiothoracic surgery in South Africa began in Cape Town spreading to the rest of the country, and since the end of apartheid slowly reaching other sub-Saharan African countries. It is a story of brilliant innovators, of the evils of the disease of apartheid but also of what is possible if you are determined and prepared to work hard. The early leaders came from the University of Cape Town (UCT) with Christiaan Barnard, Donald Ross and Rodney Hewitson all in the same class of 1946 with Ben Le Roux and Bob Frater soon after. It is a story of world class professionals in a sea of poverty. The heart transplants performed by Barnard stimulated the whole university and eventually had an effect in raising the standard of medicine in South Africa. Despite the apartheid laws at the time the cardiac unit at UCT was run as multiracial as it was possible at the time with all patients receiving the same care. Apartheid also had an effect on the emigration of many highly talented graduates to other countries. The end of apartheid caused great changes to healthcare in the country, many of great benefit but also some not so good. As UCT influenced the rest of South Africa, the South African medical fraternity can affect the rest of sub-Saharan Africa to the benefit of all its people.

**Keywords:** Cardiothoracic surgery; South Africa; history

Submitted Jul 13, 2021. Accepted for publication Nov 12, 2021.

doi: 10.21037/jtd-21-1117

**View this article at:** <https://dx.doi.org/10.21037/jtd-21-1117>

The story of cardiothoracic surgery in South Africa is a history of brilliant world breaking leaders, of the effects of apartheid, of innovation in a world of poverty and a story of what is possible if the drive and determination is present.

Thoracic surgery in South Africa was created in the late 1940's as a sub-division of general surgery. Two general surgeons from the University of Cape Town (UCT), Professor Christiaan Barnard and Professor Rodney Hewitson both left the country, Barnard for Minneapolis and Hewitson for London (under Lord Brock) to further their studies in surgery. Minneapolis was the leading cardiac unit in the world and Barnard returned to South Africa as a cardiac surgeon and with the gift of a Gibbons heart lung machine. Hewitson and Barnard opened the Cape Town cardiothoracic unit in South Africa in 1958. Nine years

later the first heart transplant occurred and the department exploded (1). Less well-known however is the amazing work performed in paediatric cardiac surgery such as tetralogy of Fallot, ventricular septal defects and Ebstein's anomalies (2,3), as well as in the surgical management of valvular disease with the design of two mechanical valvular prostheses—the UCT aortic and mitral mechanical prostheses (4-7). The department had many international surgeons spending time in the unit with patients from all over the world. Professor Robert Frater spent a number of years in the unit as did Sir Terence English, Professor Francois Hitchcock and many others.

The story starts with the UCT class of 1946. This class included Barnard (8-10) who performed the first heart transplant in 1967, his classmate Sir Donald Ross who had

<sup>^</sup> ORCID: 0000-0002-5019-8962.

a stellar career in London and the third was Hewitson who, although he did not have a world renowned reputation, was without a doubt the hands behind the brilliant Barnard. Whatever Barnard could visualise Hewitson could perform. Personally, as one of the registrars in the department I learnt more from Hewitson than any other surgeon I had the privilege to work with. He was a taciturn man, a radiological expert par excellence, and a surgeon who did not really need an assistant. You were there to watch and learn. Hewitson eventually created the separate general thoracic section as it was felt that this had become a Cinderella section under the division of cardiothoracic surgery. He was extremely religious in contrast to Barnard who was a man of the world. Barnard was brilliant, demanding, and was able to converse with the lowly registrars but also with the intellectual giants of the world. Working in his department was to be inspired by what had been achieved in really a very short time. But it was also a time of long hours, abuse from the consultants and a total intolerance of mistakes. It was also a time where the opportunity to become involved in research was always possible and influenced me for the rest of my career. Barnard would be in the operating theatre for the whole day, then many hours in the research laboratory followed by a ward round at midnight. As the registrar you were expected to be awake and waiting for him. We had a rotation of one in three, 36 hours shifts being normal. It was abnormal, inhumane, and not geared to creating a department that would survive. When Barnard retired the department had to be recreated by his successor Professor Bruno Reichard. The last South African to qualify as a cardiothoracic surgeon in Cape Town under Barnard was Dr. Joe De Nobrego who had qualified approximately 16 years before Barnard's retirement.

Barnard was a gifted, brilliant man who besides his world famous work as a transplant surgeon had produced ground-breaking work in tuberculous meningitis, in bowel surgery as a junior surgeon (11), but his weakness was that he had no succession plan and failed to train adequately the next generation. Following the cardiac transplants, the department had developed a world-wide reputation with a number of international surgeons spending time in our department. Surgical teams from Cape Town visited other countries performing operations. Barnard had a profound influence on healthcare facilities in South Africa as well as the wider world. He had many critics as well as advocates. He was criticised for performing the heart transplants in a country rife with tuberculosis. It was said that the money spent on cardiac research should have been spent on

tuberculous research. He was criticised as an elitist but the truth was that he operated on patients irrespective of colour, creed, religion or financial capabilities. Money was donated by the mining companies creating a sustainable research facility that is producing good work to this day. The cardiac program stimulated the whole medical school with Groote Schuur Hospital being very highly rated internationally. Cardiac surgery stimulated the anaesthetic team, the intensive care units, other totally unrelated research programs, and created goals for the doctors to strive for. We were constantly stimulated to ask the question why? We were never criticised for questioning our professors although the overall standard of medicine was kept at a very high standard. During the dark days of apartheid we at UCT were taught to be respectful to our patients whatever their colour or creed.

Ross (12) was by far intellectually the brightest of the three 1946 classmates. He is an example of the many South African doctors who have left the country to head many departments around the world. Sir Donald performed the first heart transplant in the United Kingdom, which did not survive, however the first successful transplant was by Sir Terrence English (13,14). English was a graduate of the University of the Witwatersrand in South Africa and very much a South African. In "The history of cardiac surgery" by Mr. Babulal Sethia (15) in 2018 he stated: "In this country (United Kingdom), the major surgical pioneers of the time were Donald Ross at Guy's Hospital and the National Heart Hospital (which later merged with Royal Brompton), Terence English at Papworth and Magdi Yacoub at Harefield Hospital". Sir Magdi Yacoub was an Egyptian cardiac surgeon who has created a great facility in his home country. To a very real extent these men left their birth countries for academic advancements.

Further examples of this is Frater (16) who graduated five years after the brilliant three at UCT. Frater studied at the Mayo Clinic and eventually headed the Albert Einstein Department of Cardiothoracic Surgery in New York. He created one of the leading cardiac surgery departments in the world and on retirement returned to South Africa where he has created a research department at the University of the Free State (17,18).

Barnard retired in 1983, to be replaced by Bruno Reichart from Germany, John Odel in 1989 (later becoming chief at Mayo Clinic, FL, USA), von Oppell in 1993 (emigrated to Wales as chief of department), and Zilla in 1998 (a Swiss who retired in 2020).

The last 20 years of the 20th century was characterised

by an AIDS outbreak in South Africa, a tuberculous explosion, a change of government and the end of apartheid with a new emphasis on primary healthcare with severe limitations being placed on specialities such as cardiac surgery. Limitations were placed on hospital beds, and prosthetic heart valves had limited availability, as well as the number of heart transplants that were being performed decreased in number. It was also the period of increasing heart transplantations being performed privately as well as an explosion in private open-heart facilities. It has also had an effect on the training of the next generation of cardiothoracic surgeons. A positive is an increase in the training of sub-Saharan foreign cardiothoracic surgeons.

Due to the financial constraints of the department, Zilla (19,20) and others created a private UCT clinical centre in the Groote Schuur complex. This was basically a private hospital created to support the provincial section. It had the added benefit of supplementing provincial salaries allowing academics to compete with their private colleagues.

The department has trained graduates from Zimbabwe, Nigeria, Zambia as well as Namibia with ongoing support of these foreign units.

Zilla (21) has driven cardiovascular research with major funding from the industry and later from The Medical Research Council of South Africa plus other international sponsors. This research has included the development of affordable catheter based valvular interventions which will be applicable to the 3rd world population in Africa.

UCT has continued to send cardiothoracic surgeons overseas to maintain the standard of its unit.

In 1986 the new Groot Schuur Hospital was commissioned. This was opened as a totally multi-racial hospital going directly against the law of the land. The superintendent at the time Dr. Hannah-Reeve Saunders was suspended. After a protracted court battle, she was exonerated and re-employed. UCT (22) fought the government over its apartheid policy over many years. Its hospital was the first academic unit in the country to become multi-racial, this occurring well before the law was retracted. It demonstrates what is possible when people are prepared to stand fast against laws that are unfair, unjust and counter-productive.

One of Cape Town's other great surgeons who has had a profound influence on pectus excavatum and pectus carinatum surgery was Professor Donald Nuss who created the Nuss procedure for pectus excavatum (23). This has changed the standard of care for this condition. Nuss was a newly qualified paediatric surgeon from the Red Cross Children's Hospital in Cape Town. He had recently moved

to Edendale Hospital in Natal where he discovered that his colleague, a man of colour was being paid a salary less than he was receiving. As a young fire-brand South African he wrote a letter to the minister of health complaining and asking for this to be rectified. The following week he was visited by the security police and banned from attending his own clinical meeting (personal communication). At this time, he decided to emigrate. Ten years later while performing the Ravitch procedure for pectus excavatum he said it was like "a bolt of lightning". He asked the question, why am I doing this? "When the dentist can straighten teeth and the orthopaedic surgeons can straighten clubfeet" why cannot we do the same to the chest. This was the beginning of his research that has changed the care of this condition, stimulated the Chest Wall International Group (CWIG) formation and for me personally created friends from all over the world. Nuss's emigration for political reasons was an example of the many highly educated South Africans of both black and white from all the professions who fled the country to our long-term disadvantage.

South Africa has had many prominent international visitors. Professor Mark Ravitch (24) was a visitor to our department in Cape Town and was a tall, highly articulate man, a paediatric surgeon, and innovator who besides his named procedure, being the first to introduce surgical staples to the Western world. Other great general thoracic surgeons who visited was Professor Griffith Pearson from Toronto as well as the head of thoracic surgery from the Mayo Clinic. What I have learnt over the years is the benefit we receive from international contacts. Our young graduates should spend time overseas returning with new ideas and stimulation to improve the quality of our local healthcare facilities. More recently Diego Gonzales (Spain) and Alan Sihoe (Hong Kong) have made a huge contribution to the local South African community running video assisted workshops.

I left the department on Barnard's retirement for Johannesburg where I completed my training under Professor Robin Kingsley. Kingsley created a vibrant department in Johannesburg. He had trained at the Mayo Clinic in the USA and returned with enthusiasm. We were a hard working dedicated and happy department that created research, good clinical outcomes and very importantly trained cardiothoracic surgeons for the future. We had dedicated general thoracic surgeons (Dr. Alan Conlan and Dr. Gerson Katz) for the non-cardiac element of our speciality and adequate clinical facilities to provide a world class clinical unit. Conlan eventually emigrated

to Canada and thereafter Boston where he became head of a cardiothoracic department. Katz was a gifted hard working surgeon in private practice who did sessions in the department. Professor Manuel Antunes succeeded Kingsley after his departure into private practice. Antunes became a world leader in mitral valve repairs eventually emigrating to Portugal. This period was complicated by political change in South Africa with the end of apartheid and the change in emphasis in medical care in the country. There was a time when the training of registrars was halted in the Johannesburg department. At present the Johannesburg unit is slowly rebuilding.

A further great Cape Town graduate and cardiothoracic surgeon was Professor Ben Le Roux (25). He studied in Edinburgh under Professor Logan. He was offered the opportunity of heading the cardiothoracic department in Durban, South Africa, where he has left a legacy that has continued to this day. Logan subsequently relocated to Durban on his retirement where he became a well-loved and vital member of the department under his previous student. Le Roux was an internationally recognised general thoracic surgeon who had a major influence in inflammatory lung disease. His graduates spread all over the country as well as many international surgeons who trained in his department, eventually heading their own departments in the country of their origin.

I have no personal experience of the Durban department. They were by far the largest department in the country with over 200 cardiothoracic beds in 2 hospitals, one for white patients, Wentworth Hospital, and the other a massive black hospital of 1,700 beds which catered mainly for tuberculous patients. This department was eventually amalgamated in the Albert Luthuli Hospital as a totally multi-racial department.

From Cape Town and Durban cardiothoracic surgery spread to the rest of the country. We now have departments in Pretoria, the Witwatersrand, Free State, Stellenbosch and a young department in the Sefako Makgatho Health Sciences University (previously MEDUNSA).

MEDUNSA was a medical school created under the apartheid government to cater for the black medical professionals. The cardiothoracic department was headed by Professor Cronje but it was only when Professor Lucas Mohlala was appointed in 1992 that the department really grew and could be considered an adequate academic department. Mohlala was a prodigy of Le Roux and he introduced the very high standards that he had been taught into his own department. On his retirement he left a department that one could be proud of. Today the university

has been renamed Sefako Makgatho Health Sciences University and is producing cardiothoracic surgeons who are a credit to the department.

## Research

UCT has a vibrant research department with ongoing work in many aspects (19). The Kwazulu-Natal Research Institute for tuberculosis and HIV, which is based at the Nelson R. Mandela Medical School, has many projects researching the role of surgery in inflammatory lung disease, particularly tuberculosis and HIV. The department also has an attachment to the Karolinska Institute in Stockholm and have a combined research project investigating a possible role for mesenchymal stromal cells in the treatment of tuberculosis.

The Free State University (17,18) has the Robert W. M. Frater Cardiovascular Research Centre.

The Sefako Makgatho Health Sciences University also have a research department involved in mainly non-cardiac thoracic surgery (26,27).

Funding for research is always a problem. UCT and Free State University have strong private funding with UCT also supported by the Medical Research Council, which is a government funded organization. The other universities struggle to obtain adequate funding.

All medical schools in South Africa are multiracial. In keeping with the racial profile of the country, which is 80% black South Africans, most of our registrars are of colour. Our constitution states: "everyone is equal before the law and has the right to equal protection and benefit of the law" (28). South Africa is to a greater extent reflecting the demographic picture of its people.

Apartheid was the scourge of South Africa. It was a system of equal but separate for all services in the country. It kept the races separate making it a criminal offence to interact across race lines, to love each other etc. But of course, it was not equal. In the healthcare environment wards were kept separate and in many cases were separate hospitals. The ideal was thought to be white nurses for white patients and black nurses for black patients. It was a system that was doomed to failure from the moment it was implemented, but it took a generation to be eradicated and we are living with the results of this disease today.

But how did we in Cape Town run our department? I was a registrar in the department at the time from 1977 and my comment is from personal experience. At the time the law of the land made it a criminal offence to mix the races.

Chris Barnard however, following the cardiac transplants had the international reputation that placed his team above the law (23). We had 2 wards at Groote Schuur Hospital which were kept separate but in all other aspects the department was run as a multiracial department. The two intensive care units were used alternatively and were totally mixed as were the theatres. At the Red Cross Children's Hospital, the department was totally multi-racial with the older children in one ward and the younger in another. Barnard's father was a pastor to a coloured community and he was exposed to the evils of apartheid at a very young age. Although he was not a politician, he made his feelings very clear to the department. His brother, Professor Marius Barnard, who was also a cardiac surgeon in the department did eventually go into politics as an opposition politician, fighting the government of the day. The department was run as ethically as possible during a very difficult time.

The years during the apartheid period resulted in many highly talented South Africans leaving the country to pursue their careers and lives in a more amicable environment. It also placed a moratorium on involvement of South Africans in sub-Saharan Africa in which the need was overwhelming. In a very real sense, outside South Africa but in sub-Saharan Africa, if you had money you travelled, if you did not have money you died. Cardiothoracic surgery in Africa has now changed dramatically with South Africa training surgeons from many other sub-Saharan countries. Of our seven cardiothoracic units, four are now headed by black South Africans. South Africa is training surgeons from many other countries. Apartheid did however lead to many leading South African cardiothoracic surgeons leaving the country to in many cases head up units internationally.

During my training from 1977 to 1985 the predominant cardiac diseases were related to rheumatic fever and the resultant valve surgery. Over the years this has changed with the increase in coronary artery disease. Rheumatic fever however is still endemic in the poorer environments and will only disappear when the general health services improve in the country. During those early days coronary artery diseases in the poorer black communities was almost non-existent. As the economic environment changed, we have altered our lifestyles with a change in the disease patterns. South Africans of Indian descent have a very high incidence of diabetes with a subsequent high coronary artery disease pattern.

### General thoracic surgery

UCT, WITS and Durban universities had dedicated general

thoracic surgeons in the 60's, 70's and 80's. Le Roux and Logan ran the largest non-cardiac general thoracic unit training many local South Africans. Both the Cape Town and Johannesburg units separated the cardiac and non-cardiac aspects of the speciality. Over the years however the glamour of cardiac surgery has over-shadowed the other very important aspects to the disadvantage of the non-cardiac cardiothoracic surgeon. This is an aspect that needs to be addressed to prevent further deterioration in the training.

In 1991 laparoscopic surgery was introduced into South Africa followed by thorascopic surgery in my own practice. At this stage there was no academic unit involved and I was forced to spend time internationally learning the speciality (29). Thorascopic surgery has slowly increased over the last 30 years and is now considered a normal part of the armamentarium of the thoracic surgeon. The Nuss procedure for pectus excavatum was the natural progression as a minimally invasive approach for the condition and was introduced in 2008.

### International meetings in South Africa

International collaboration is an important step in the training of young South African specialists. We have had the privilege of hosting the World Society of Cardiovascular and Thoracic Surgeons (2019) as well as the Chest Wall International Society meeting (2019). These international meetings have had a profound influence on our training and the stimulation of our young graduates. In our Covid world, online meetings have replaced these meetings. I would suggest that at some stage in the future we will need to return to a formal Congress setting, not only for the academic input but very important for the interaction between international surgeons.

### International contact

Over the years many South Africans have spent time overseas returning to the country to pass on their knowledge. The Mayo Clinic in the United States has trained a number of South Africans. Attendance of international meetings has been encouraged and supported by the academic departments and is a vital part of our training. The alternative approach is to invite international speakers to our conferences. At our annual meetings tremendous stimulus were the visits of Diego Gonzales-Rivas and Alan Sihoe. Animal wet labs were arranged to



demonstrate thorascopic lobectomies followed by the international visitors performing in our theatres. These live surgical procedures were by far the most important part of their visits as it demonstrated dramatically what was possible. Following these visits a number of South African have visited the Shanghai Lung Hospital returning to their home countries as more innovative surgeons.

During my lifetime in South Africa, we have seen the beginnings and the blossoming of a new speciality with, in the early days a strong local general thoracic aspect, this being replaced by the influence of the glamorous cardiac surgery, progressing to minimally invasive approaches in the cardiac and non-cardiac aspects. The future of the South African speciality includes advances into sub-Saharan Africa with benefit to the whole continent. South Africa has been involved in Botswana, Namibia, Mozambique, Zambia and Zimbabwe.

Registrars sent from these countries are funded from their home countries and are expected to return on completion of their training. So much more needs to be done in the whole sub-Saharan area. The driving force needs to be the local Africans with added assistance from the international community. As was the case in South Africa, our early leaders were trained internationally, had some financial assistance, but the driving force and eventually the financial support came from the local community.

South Africa has a bright future. The UCT remains a world-leading medical school (30), rated 70th out of the top 500 world-wide and the best in Africa, producing cardiothoracic surgeons who can compete with the best in the world. We are slowly increasing the number of registrars from other sub-Saharan countries. The university also sends teams to assist with mainly congenital cardiac surgery in these countries.

Training of medical schools and specialists is only in government institutions. Private medical schools are not accredited. South Africa has approximately 120 cardiothoracic surgeons in the country with about 60% in the private sector, many with government part-time appointments. Most are in the main centres with the rural areas poorly serviced. UCT is the only medical school with a heart transplant program but with transplants also performed in the private sector in Cape Town and Johannesburg. We also have a great deal of trauma, with the resultant chest problems, tuberculous-related chest disease and still significant rheumatic valvular disease. In the more affluent communities, we mirror what is seen in the developed world.

As UCT medical school influenced the whole country especially the department of cardiothoracic surgery, so can South Africa influence the whole of sub-Saharan Africa in developing a world-class service in all aspects of medicine including of course cardiothoracic medicine.

## Acknowledgments

*Funding:* None.

## Footnote

*Provenance and Peer Review:* This article was commissioned by the Guest Editor (Alan D. L. Sihoe) for the series “Thoracic Surgery Worldwide” published in *Journal of Thoracic Disease*. The article has undergone external peer review.

*Peer Review File:* Available at <https://jtd.amegroups.com/article/view/10.21037/jtd-21-1117/prf>

*Conflicts of Interest:* The author has completed the ICMJE uniform disclosure form (available at <https://jtd.amegroups.com/article/view/10.21037/jtd-21-1117/coif>). The series “Thoracic Surgery Worldwide” was commissioned by the editorial office without any funding or sponsorship. The author has no other conflicts of interest to declare.

*Ethical Statement:* The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

*Open Access Statement:* This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

## References

1. Barnard CN. The operation. A human cardiac transplant: an interim report of a successful operation performed at Groote Schuur Hospital, Cape Town. *S Afr Med J*

- 1967;41:1271-4.
2. Barnard CN, Schrire V. Surgical correction of ebstein's malformation with prosthetic tricuspid valve. *Surgery* 1963;54:302-8.
  3. Barnard CN. The surgical treatment of tetralogy of Fallot. *N Z Med J* 1965;64:Suppl:24-5.
  4. Barnard CN. Mitral replacement with the U.C.T. prosthesis. *N Z Med J* 1965;64:Suppl:50-2.
  5. Beck W, Fergusson DJ, Barnard CN, et al. Hemodynamic findings following replacement of the mitral valve with the University of Cape Town prosthesis. *Circulation* 1965;32:721-31.
  6. Beck W, Barnard CN, Schrire V. The hemodynamics of the University of Cape Town aortic prosthetic valve. *Circulation* 1966;33:517-27.
  7. Schrire V, Beck W, Hewitson RP, et al. Immediate and long-term results of aortic valve replacement with University of Cape Town aortic valve prosthesis. *Br Heart J* 1970;32:255-63.
  8. Munnik LAPA. Chris Barnard – a most remarkable personality. In: Cooper DKC. editor. *Chris Barnard - by those who know him*. Cape Town: Vlaeberg Publishers, 1992:254-8.
  9. Cooper DK. Christiaan Barnard and his contributions to heart transplantation. *J Heart Lung Transplant* 2001;20:599-610.
  10. Cooper DKC. Christiaan Barnard-The surgeon who dared: The story of the first human-to-human heart transplant. *Glob Cardiol Sci Pract* 2018;2018:11.
  11. Barnard CN, Louw JH. The genesis of intestinal atresia. *Minn Med* 1956;39:745; passim.
  12. Available online: <https://www.ahajournals.org/doi/pdf/10.1161/circ.115.9.f33>
  13. Available online: <https://royalpapworth.nhs.uk/our-hospital/latest-news/sir-terence-english-40-years-uk-first-successful-heart-transplant>
  14. Available online: <https://www.gresham.ac.uk/professors-and-speakers/sir-terence-english-kbe-frcs-frcp/>
  15. Sethia B. The history of cardiac surgery. Available online: <https://www.rbht.nhs.uk/blog/history-cardiac-surgery>
  16. Available online: <http://communication.bishops.org.za/college/documents/RobertGrayMedal.pdf>
  17. Available online: <https://professorpositions.com/postdoctoral-research-fellowship-in-cardiothoracic-surgery;i18647.html>
  18. Available online: <https://www.ufs.ac.za/templates/news-archive/campus-news/2018/august/applications-for-2019-are-now-open?NewsItemID=10185>
  19. Available online: [http://www.cts.uct.ac.za/Cardiovascular\\_Research](http://www.cts.uct.ac.za/Cardiovascular_Research)
  20. Available online: <http://www.chi.uct.ac.za/>
  21. Available online: <http://www.cts.uct.ac.za/Staff/CVRU>
  22. Sanders HR, Kane-Berman J. UCT's Medical Faculty and Groote Schuur Hospital. *S Afr Med J* 2012;102:394-5.
  23. Available online: <https://www.chkd.org/our-services/nuss-procedure/history-of-pectus-excavatum-treatment/>
  24. Mark M. Ravitch: a Surgeon's Surgeon. Available online: <https://circulatingnow.nlm.nih.gov/2016/10/25/mark-m-ravitch-a-surgeons-surgeon/>
  25. University of Kwa-Zulu Natal. Available online: <https://ctsurgery.ukzn.ac.za/aboutus/>
  26. Available online: <https://purerims.smu.ac.za/en/organisations/cardiothoracic-surgery>
  27. Available online: <https://purerims.smu.ac.za/en/organisations/cardiothoracic-surgery/publications/>
  28. Constitution of the Republic of South Africa, Chapter 2 Bill of rights 9.1, 1996. Available online: <https://www.gov.za/documents/constitution/chapter-2-bill-rights>
  29. Schewitz I. Thoracoscopy: The past, the present and the future! A personal journey. *Afr J Thorac Crit Care Med* 2018;24:10.7196/AJTCCM.2018.v24i1.182.
  30. Available online: [https://www.timeshighereducation.com/world-university-rankings/2018/subject-ranking/clinical-pre-clinical-health#!/page/2/length/25/sort\\_by/rank/sort\\_order/asc/cols/stats](https://www.timeshighereducation.com/world-university-rankings/2018/subject-ranking/clinical-pre-clinical-health#!/page/2/length/25/sort_by/rank/sort_order/asc/cols/stats)

**Cite this article as:** Schewitz I. Cardiothoracic surgery in South Africa: a history. *J Thorac Dis* 2022;14(4):1275-1281. doi: 10.21037/jtd-21-1117