Review article

Know thy neighbors: The status of cardiac surgery in the South Asian countries around India

Nazmul Hosaina,⁎, Farzana Aminb, Somaiya Rehmanc, Bhagawan Koiralad

a Department of Cardiac Surgery, Chittagong Medical College, Chittagong, Bangladesh
b Clinical Programs, Northern Health, Prince Georges, British Columbia, Canada
c Department of Cardiothoracic Surgery, Rehman Medical Institute, Peshawar, Khyber-Pakhtuhwa, Pakistan
d Department of Cardiothoracic and Vascular Surgery, Tribhuvan University Institute of Medicine, Kathmandu, Nepal

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ABSTRACT

Objectives: The South Asian neighboring countries of India include Bangladesh, Bhutan, Nepal, The Maldives, Pakistan and Sri Lanka. Interestingly all these countries possess either a land or a sea border with India and no border among themselves. These countries have historic, cultural, ethnic and genetic links with India. The paper describes the developmental history and current status of cardiac surgery in these countries.

Methods: Thorough search of the printed and electronic materials has been made. The authors visited all these countries and contacted the eminent surgeons personally or through mails. All the information is cross-checked and compiled. Record keeping is not well organized in most of these countries. Best information often came from unusual sources like Anesthetists’ society or the corporate houses.

Results: Four of these countries Bangladesh, Nepal, Pakistan and Sri Lanka have their cardiac surgical programs. Collectively they perform around 38000 cardiac operations a year which is a quarter of the cases performed in India. These countries are important sources of medical tourism in India which is worth 3 billion US$ of business annually.

Conclusion: When the number of operations per million populations is considered, Bangladesh and Nepal are lagging behind India where as Pakistan has a comparable figure. Sri Lanka with 265 cardiac operations/million populations has the best figures in the region. However when compared with the Western countries even the Lankan figures also look quite inadequate.

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⁎ Corresponding author.
E-mail address: heartsurgeon007@gmail.com (N. Hosain).

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Introduction

South Asia is the south central part of the Asian continent. The countries and people of this area have long standing historic and cultural links. Union of India is the biggest country of the region today. The South Asian neighboring countries of India are Bangladesh, Bhutan, Nepal, Maldives, Pakistan and Sri Lanka. Interestingly all these countries possess either a land or a sea border with India and no border of any kind among themselves. Some of these borders are surprisingly long. For example the India-Bangladesh border is the 5th longest international border of the World stretching along 4096.7 km with densely populated areas on both sides. 1 Indian borders with Pakistan, Nepal and Bhutan are also quite long (Table 1). Sri Lanka is separated from India by the Palk Strait.

These countries are also important sources of medical tourism in India. Medical tourists visiting India annually contribute around 3 billion US$ worth of business. Medical tourism has grown rapidly during the past decade and several Asian countries have become dominant destinations. 2 Investment in the medical industry is recognized as an important way of increasing GDP, improving services and boosting tourism. 3 The number of all visitors to India from Bangladesh is the second highest only next to USA. In terms of the number of medical tourists to India, Bangladesh tops the list. Out of 56129 persons visiting India with medical visa in 2013, Bangladesh alone numbered 17814 (31.7%). 4 Other south Asian countries also send significant number of medical tourists to India. The number of medical tourists to India rose to 134344 in 2015. It is estimated that medical tourism business in India may reach US$ 8 billion by 2020. 5

Friend or foe whatever be the status, these south Asian countries have strong historic, cultural, ethnic and genetic ties with India. China and Myanmar, the two other countries bordering India are quite different in this regard. Knowing the current status of the South Asian neighbors may be of strategic importance for the Indian physicians and surgeons.

Methods

Record keeping and data compilation in these countries are not well organized in most cases. Authentic information is hard to find. Best information often came from unusual sources like Anesthetists’ society or the corporate houses. The major manufacturers of cardiac surgical disposables were contacted for the numbers from their own database. Thorough search of the printed and electronic materials has been made. The authors visited all the neighboring countries of India and contacted the eminent surgeons personally or through mails. All information is cross-checked and then compiled. However no personal or individual data was accessed, hence possibility of breach of patient confidentiality is not there.

Pakistan

Closed heart operations in Pakistan began by the native surgeons in the late 1950s at a few centers of Karachi, Lahore and Rawalpindi. But open heart operations began by Dr Donald Edward Bowes, a Canadian born missionary surgeon in 1967–68 at United Christian Hospital Lahore. 6,7 Among the locals an army surgical team performed the first open heart surgery of undivided Pakistan on the 4th of March 1970 at the Rawalpindi Military Hospital 8 (Fig. 1). The chief surgeon was Dr Lieutenant Colonel Ali Masood Akram and the chief cardiologist was Dr Major Md Abdul Malik representing the Western and Eastern parts of the then Pakistan respectively. Pakistan broke apart in 1971 and Eastern Part became an independent country, Bangladesh.

Regular cardiac surgical program among the civilians began in the remainder (West) of Pakistan with the establishment of National Institute of Cardiovascular Diseases at Karachi in the early 1970s. Following the era of Dr Bowes, cardiac surgery in the northern region of Punjab began again around 1978 at the Mayo Hospital Lahore.

The estimated number of cardiac operations of Pakistan performed in 2016 is more than 20 thousand. These operations were performed by around 160 surgeons in more than 40 centers with the help of about 100 perfusionists. With bigger population of the North, the centers of Lahore, Rawalpindi and Islamabad in the Punjabi heartland now dominate the numerical scenario. In the south, Karachi is still the most important venue hosting several major centers. Interestingly the historic city of Peshawar in the North-Western Khyber Pakhtunkhwa province has 6 centers performing cardiac surgery (Fig. 2A). Table 2 contains a list of major centers in Pakistan offering cardiac surgery with their geographical locations. Pakistani surgeons perform almost all varieties of cardiac operations except too complicated complex congenitals and cardiac transplantations.

Bangladesh

At Dhaka closed heart operations began in the 1960s when it still was the capital of the then East Pakistan. Major Malik, the chief

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Table 1

| Country   | Length of border | Remarks                                      |
|-----------|------------------|----------------------------------------------|
| Bangladesh| 4096kms          | 5th longest international border of the World|
| Pakistan  | 3323kms          | There are areas of dispute along the Jammu and Kashmir region |
| Nepal     | 1751kms          | Along Uttarakhand, Uttar Pradesh, Bihar, West Bengal & Sikkim |
| Bhutan    | 699kms           | Along West Bengal, Sikkim, Assam and Arunachal |
| Sri Lanka | 100m             | One of the shortest international borders of the World (not mentioned in some references) |

* The length of border with Pakistan described here is according to the website of the Ministry of Home Affairs, Government of India. Length of de facto border along the line of control may be different.
cardiologist of the pioneering Pakistani open heart operation team of 1970 is a Bangladeshi. Later he played a significant role in the development of cardiac care services in Bangladesh. Formal well organized cardiac surgical services began here with the establishment of Institute of Cardiovascular Diseases (ICVD) in 1978 by Late Bangladeshi President Ziaur Rahman. Japan International Cooperation Agency (JICA) and the Government of Japan provided technical and financial assistance in the early days. The first open heart surgery of independent Bangladesh was performed on the 18th of September 1981. Visiting Japanese
surgeon Dr Kome Saji along with the two pioneering Bangladeshi cardiac surgeons, Prof M Nabi Alam Khan and Prof Sirajur Rahman Khan (popularly known as S R Khan) had performed the first operation. Overseeing this event Major, later retired Brigadier Abdul Malik had earned a rare distinction of being part of the pioneering cardiac surgery teams of two countries, Pakistan and Bangladesh. Bangladesh Postal Department issued a stamp and a first day cover commemorating the 30th anniversary of this event.9

As of May 2017, a total of 25 Bangladeshi hospitals are offering regular cardiac surgical services (Table 3). 2 of those are run by the Government, 1 by the army and 1 is run as part of the autonomous medical university. The remainder 21 hospitals are private enterprises. A few more centers are on the pipeline. Out of these 25, 20 are located at Dhaka, 2 at Chittagong (Fig. 2C) and 1 each at Dinajpur, Sirajganj and Khulna. 2 of these hospitals namely Dhaka Apollo and Fortis Khulna have official collaboration with Indian centers.

The total number of cardiac operations in 2016 was 11121 as reported by the Society of Cardiothoracic anesthetists.10 National Heart Foundation has performed the highest number of cardiac cases as they have been doing for the last few years. Next are National Institute of Cardiovascular Diseases (NICVD) Dhaka and the United Hospital Dhaka. Bangladeshi surgeons are performing almost all types of cardiac operations with a few exceptions. It is estimated that On Pump Coronary Arterial Bypass Graft (OPCAB) operations outnumber on pump Coronary Arterial Bypass Graft (CABG) operations by 3:1 ratio. Valvular operations performed here include Aortic Valve Replacements, Mitral Valve Replacements, Double Valve Replacements and a very few repairs. Among congenital operative corrections of Atrial Septal Defects, Ventricular Septal Defects, Patent Ductus Arteriosus and Tetralogy of Fallots are regular affairs. More complicated operations like correction of Transposiion of Great Arteries or Fontan operation are also performed in 3 centers at Dhaka. Bangladesh is yet to have any

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**Table 2** Major Cardiac Surgery Centers of Pakistan.

| Location               | Hospitals                                                                 |
|------------------------|---------------------------------------------------------------------------|
| Sindh                  | 1. NICVD, Karachi
                        | 2. Liaquat National Hospital, Karachi
                        | 3. Agha Khan Hospital, Karachi
                        | 4. Dow University of Health Science, Karachi
                        | 5. Tabba Heart Institute, Karachi
                        | 6. Karachi Institute of Heart Diseases:
                        | 7. Indus Hospital, Karachi
                        | 8. KIDH Karachi
                        | 9. Medicare Cardiac and General Hospital, Karachi
                        | 10. South City Hospital, Karachi
                        | 11. Civil Hospital, Hyderabad
                        | 12. Liaquat University of Medical Sciences, Jamshoro
                        | 13. Gambat Institute of Medical Sciences, Gambat Sindh
                        | 14. Patel Hospital, Karachi
                        | 15. Dow Institute of Cardiology, Ojha Campus
                        | 16. Isra University Hospital, Hyderabad |
| Punjab & Federal Capital Territory | 1. Punjab Institute of Cardiology, Lahore
                        | 2. Doctors Hospital, Lahore
                        | 3. Army Cardiac Center, CMH, Lahore
                        | 4. Omar cardiac Center, Lahore
                        | 5. King Edward Medical University, Mayo Hospital, Lahore
                        | 6. Akhtar Saeed Medical & Dental College Hospital, Lahore
                        | 7. Surgimed Hospital, Lahore
                        | 8. Shalamar Cardiac Center & Medical College, Lahore
                        | 9. Gulab Devi chest hospital,Lahore
                        | 10. National Defence Hospital, Lahore
                        | 11. Shaikh Zayed hospital, Lahore
                        | 12. Jinnah Hospital-Allama Iqbal Medical College, Lahore
                        | 13. Rawalpindi Institute of Cardiology, Rawalpindi
                        | 14. Armed Forces Institute of Cardiology, Rawalpindi
                        | 15. Pakistan institute of medical sciences(PIMS), Islamabad
                        | 16. Shifa international Hospital, Islamabad
                        | 17. Wazirabad Institute of Cardiology, Wazirabad
                        | 18. Chaudhry Pervaiz Elahi Institute of Cardiology, Multan
                        | 19. Faisalabad Institute of Cardiology
                        | 20. Peshawar Institute of Cardiology
                        | 21. Rahimyar Khan
                        | 22. Saddique Saddiq Memorial Trust, Gujranwala
                        | 23. The Cardiac Center, Ittefaq Hospital, Lahore
                        | 24. Multan Road, Lahore
                        | 25. Center of Pediatric Cardiac surgery, Lahore
| Khyber Pakhtunkhwa     | 1. Peshawar General Hospital, Peshawar
                        | 2. Lady Reading hospital, Peshawar
                        | 3. Rehman Heart Institute, Peshawar
                        | 4. Peshawar Institute of Medical Science, Peshawar
                        | 5. Northwest General Hospital and Research Institute, Peshawar
                        | 6. Ayub General Hospital, Peshawar |

As of 2016 no center in Balochistan, Gilgit-Baltistan, Federal administered tribal areas or Pakistan controlled territory of Jammu and Kashmir is performing cardiac surgery.
cardiac transplantation program. Most Bangladeshi surgeons are trained locally and hold Master of Surgery (Cardiovascular & Thoracic Surgery) degree.

**Sri Lanka**

Despite its small area and population, cardiac surgery began in Sri Lanka or the then Ceylon quite early. Closed heart operations began in Sri Lanka by a WHO sponsored visiting Danish surgeon Professor Husfeld in 1952. Dr Arthur Terence Sahananand Paul popularly known as A T S Paul was the pioneer in cardiac surgery among the native Lankan surgeons. He established a thoracic surgery unit in 1951 at the then General Hospital of Ceylon, which is the National Hospital of Sri Lanka today. Dr Paul gave a wonderful presentation in 1963 in front of the Sri Lankan surgeons describing the first decade of cardiac surgery 1953–1963. Being trained in cardiac surgery at the Georgetown University USA, Dr A T S Paul returned to Sri Lanka in 1966 to resume operations. The first open heart surgery in Sri Lanka was performed by Dr Paul at the General Hospital the same year.

The approximate number of cardiac operations performed in Sri Lanka in 2016 is 5500. The number of operating surgeons is 24. The number of cardiac anesthetists and perfusionists is 21 and 48 respectively. There are 11 centers offering cardiac surgery in Sri Lanka. These centers are located in Colombo, Kandy, Galle and Jaffna. In 2016 the estimated Sri Lankan population is 21 million. That makes the number of cardiac operations around 265/million population, which is by far better than that of any other South Asian nations including India.

**Nepal**

Dr Dinesh Nath Gonalp attempted the first closed mitral valvotomy of Nepal at Bir Hospital in 1965. The anesthetist Dr G P Rajwalot administered anesthesia using a Boyle machine with Ether vaporizer. Dr Lok Bikram Thapa and Dr Damodor Prasad Pokhrel started doing closed heart cases establishing a separate thoracic surgery unit at Bir Hospital. Dr Alain Gale from Australia made a few visits to Bir Hospital with his team between 1985 and 1995. In the early 1990s Dr Leonard Lee Bailey and his team from Loma Linda University USA also performed a few cases in Nepal. Visiting teams continued their visits to Nepal and performed open heart procedures between 1995 and 1997 at Tribhuvan University Teaching Hospital (TUTH). The first open heart surgery by an all Nepalese team was performed at TUTH on 27th February 1997. Dr Bhagwan Koirala was the pioneer surgeon of that operation along with Dr Govind Sharma and Dr B M Singh. With establishment of Shahid Gangalal National Heart Center (SNGHC), the cardiac care in the country took a different height from 2001. Dr Koirala served as the Chief Cardiac surgeon and the executive Director of the hospital till 2009.

The number of cardiac surgical procedures in Nepal was around 2000 in 2016. Gangalal with 1400 cases was the highest performer. Manomahan Cardiac and Vascular Center of Trivun University performed around 600 cases (Fig. 2D). Besides these two major centers, a few private hospitals performed around 100 cases. Dhulikhel Hospital, Chitwan Medical College and BP Koirala Institute of Health Science at Dharan are the centers outside Kathmandu where the facilities for cardiac surgery exist. Nepal has 15 cardiac surgeons and 15 cardiac anesthetists. 7 perfusionists are performing mainly being attached to those major hospitals.

**Bhutan and The Maldives**

Due to their small size of population and geographical isolation, it is difficult to sustain a cardiac surgical program at Bhutan and The Maldives. Rather it seemed more convenient to evacuate their
patients to India or elsewhere and get the operation done. However things might change with creation of better infrastructure in near future. There had been initiatives from these small south Asian nations to establish cardiac surgery. Bhutan attempted collaboration with a Chennai hospital in 2003. A senior cardiac surgeon made visits to Bhutan in an attempt to start cardiac surgery. But that endeavor has not been successful till date.

The Maldivian government has also taken initiative to start cardiac surgery, but here also any plan is yet to be materialized. As of May 2017, they have performed coronary Angiograms, PTCA's and a few device closures of ASD. The preparation for full-fledged cardiac surgical operation is in progress and is expected to start soon. The two major hospitals of Maldives are Indira Gandhi Memorial Hospital and the A D K Hospital. Another big hospital named Treetop Hospital is being constructed in the Hulhumale island.

Results & discussion

4 of the South Asian countries namely Bangladesh, Nepal, Pakistan and Sri Lanka have their established cardiac surgical programs. Collectively they perform around 38000 cardiac operations a year which is around quarter of the cases performed in India. The combined population of these four is around one-third of that of India. When the number of operations per million populations is taken into consideration, Bangladesh and Nepal are lagging far behind where as Pakistan has a nearly comparable figure with India (Table 4). Sri Lanka has the best numbers in this regard even quite ahead of India and Pakistan. However even the Lankan figure appears inadequate when compared with the western World. The estimated number of cardiac operations performed in USA annually is around 700000.15,16 With its population of 324 million,17 the number of operations per million population stands at 2160, an 8 fold higher figure than even the best performance of Sri Lanka at 265. If the USA figures are considered extravagant and apparently more logical rate of Germany is taken into consideration, that is also much higher compared to South Asian figures. The number of cardiac surgical procedures entered into the register of German Society of Cardiovascular & Thoracic Surgery in 2015 was 10396718 and that in 2014 was 100398.19 With population of 80 million,20 the annual number of registered operations per million populations comes around 1299, far better figures than any of the South Asian nations.

It should be mentioned here that the definition of surgeon couldn’t be standardized as the data from different countries were aggregated from different sources. The data from some of the countries counted the operating surgeons only where as others might have included assisting surgeons as well. The definition of operating surgeon is also often vague. Complicating the scenario even more was the issue of segregating the cardiac surgeons from the thoracic and vascular surgeons. So the Surgeon: population ratio mentioned here might not be accurate, rather it gives a rough idea about the prevailing situation.

Conclusion

Cardiac surgery as a subject has flourished at least in four of Indian neighbors. Pakistan, Bangladesh, Sri Lanka and Nepal have their own cardiac surgery programs. Bhutan and Maldives are yet to start their own cardiac surgical program. These 4 countries together perform around 38000 cases per year. However that figure is not adequate considering their population. This fact might have encouraged medical tourism to India. When number of operations per million populations is concerned, only Sri Lanka has a better performance than India, whereas Pakistan’s performance is close to that of India. Taking into consideration of the inadequacy of surgery, the surgeons and policy makers should focus on ensuring enhanced capacity building and creation of infrastructure to provide proper cardiac care of the South Asian population.

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