Establishing a children's orthopaedic hospital for Malawi: A review after 10 years

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Abstract

Background

BEIT CURE International Hospital (BCIH) opened in 2002 providing orthopaedic surgical services to children in Malawi. This study reviews the hospital's progress 10 years after establishment of operational services. In addition we assess the impact of the hospital's Malawi national clubfoot programme (MNCP) and influence on orthopaedic training.

Methods

All operative paediatric procedures performed by BCIH services in the 10th operative year were included. Data on clubfoot clinic locations and number of patients treated were obtained from the MNCP. BCIH records were reviewed to identify the number of healthcare professionals who have received training at the BCIH.

Results

609 new patients were operated on in the 10th year of hospital service. Patients were treated from all regions; however 60% came from Southern regions compared with the 48% in the 5th year. Clubfoot, burn contracture and angular lower limb deformities were the three most common pathologies treated surgically. In total BCIH managed 9,842 patients surgically over a 10-year period. BCIH helped to establish and co-ordinate the MNCP since 2007. At present the program has a total of 29 clinics, which have treated 5748 patients. Furthermore, BCIH has overseen the full or partial training of 5 orthopaedic surgeons and 82 orthopaedic clinical officers in Malawi.

Conclusion

The BCIH has improved the care of paediatric patients in a country that prior to its establishment had no dedicated paediatric orthopaedic service, treating almost 10,000 patients surgically and 6,000 patients in the MNCP. This service has remained consistent over a 10-year period despite times of global austerity. Whilst the type of training placement offered at BCIH has changed in the last 10 years, the priority placed on training has remained paramount. The strategic impact of long-term training commitments are now being realised, in particular by the addition of Orthopaedic surgeons serving the nation.

Introduction

The BEIT CURE International Hospital (BCIH) is a 72-bed orthopaedic teaching hospital based in Blantyre, southern Malawi. It specialises in the surgical treatment and orthopaedic needs of children and adults of Malawi and neighboring countries. It is a non-denominational Christian hospital that offers, without any obligation, Christian counseling and prayer for guardians and patients. The mission statement of this organisation is "To provide a service that is free for the treatment of children with physical disabilities regardless of ethnic background, religious affiliation or ability to pay." A full range of specialist orthopaedic services is also available to paying adults, which generates income to sustain free paediatric services and also allows greater range of exposure for trainees. BCIH has been operational since 2002 and manages 9,000 patients per year, with up to 1,200 patients receiving surgical treatment. The hospital treats a wide variety of orthopaedic pathologies including clubfoot, burn contractures, osteomyelitis and other acquired or congenital conditions. In addition, BCIH provides outpatient care in terms of rehabilitation, physiotherapy and pain clinics.

The hospital runs a peripheral outreach clinic program, conducting mobile clinics in central and northern district hospitals of Malawi. Less frequently, outreach clinics visit Mozambique to identify children who may benefit operative management at BCIH and to provide local follow up care for post-operative patients. Over the last 10 years BCIH has played an integral role in teaching, and training by hosting medical, nursing, and physiotherapy students in addition to postgraduate surgical trainees. Between April 2002 and 2009 BCIH provided a high quality training program for Orthopaedic Clinical Officers (OCO) in Malawi. Currently, the hospital also offers several international postgraduate opportunities including two annual fellowships. This study aims to follow on from our previous paper "Establishing a children's orthopaedic hospital for Malawi: An assessment after 5 years"[1].We aim to review the hospital's progress after 10 years of operational service. In addition to the previous paper we aim to assess the hospital's contribution to the orthopaedic workload for Malawi, the Malawi national clubfoot program, and impact on orthopaedic training.

Methods

All patients treated at BCIH or by BICH services at peripheral centers over the last 10 years were recorded in a Microsoft Access Database. The study was conducted by collecting data from the electronic database files of 609 new patients, treated operatively between 1st Feb 2012 and 31st Jan 2013 - the 10th year of operative service. The exclusion criteria were private patients and adults. Microsoft Excel (version 14.3.5) was used to compile the data and included the sex, age, district, country and diagnosis of each patient. The top 12 pathologies were identified, ranked and compared with the results of the 5-year study.Data analysis included peripheral BCIH services at Mzuzu Central Hospital. Data was collected from physical logbooks in Mzuzu from 2004 to present. Data recorded included number of inpatients and outpatients reviewed and number of operations performed by BCIH services. The type of operation performed in Mzuzu was not recorded. To determine the contribution of BCIH to the total burden of orthopaedic workload for Malawi, data was collected on the number of paediatric orthopaedic operations performed nationwide for the same time period, through other orthopaedic hospitals (government and non-government organisations) in Malawi. There is currently no national mandate to ensure accurately recorded data. BEIT CURE, Lilongwe and Mzuzu hospital keep accurate up to date surgical logbook books, which were used for data collection. Data was also obtained from the Malawi National Clubfoot Database to identify clubfoot clinic locations and number of patients treated. Finally, BCIH records were reviewed to ascertain the number of nurses, medical students and orthopaedic clinical officers who have attended courses or placements at the BCIH over the last 10 years and the subsequent clinical output of trained individuals.

Results

In total 609 paediatric operations were performed during the

10th year that BCIH has been operating. The sex distribution (Table 1, Appendix) revealed that 242 of the 609 patients were female (40%) and 367 were male (60%). In total 34 patients came from northern Malawi (5.6%), 198 patients came from central Malawi (32.5%), 359 patients came from southern Malawi (59%), 18 patients came from other countries either Mozambique or Zimbabwe (2.9%).\ The districts and region summary are shown in table 2 (Appendix). Compared with the 5-year review there is almost a 10% increase in patients originating from Southern Malawi and a subsequent fall in patients referred from northern and central Malawi (Table 3, Appendix). The most common pathologies treated surgically in the 10th year of service were (1) Clubfoot (2) Genu Valgus (3) Burn Contracture. The top 12 diagnoses in 5th year of service and 2013 can be seen in table 4 (Appendix). The age distribution of 2013 patients showed that 42% of the children were five years or younger and 74% were less than 11 years of age. In the 5th year of service, 80% of children were under 11 years old (Table 5, appendix). It was hypothesised that the number of children requiring operations for clubfoot may have fallen since the successful implementation of Ponseti treatment in Malawi. In view of this the clubfoot data was specifically analysed showing that the rate of clubfoot surgery had fallen from 15% of operative workload at 5 years to 13% at 10 years.The age at which clubfoot surgery was performed was also recorded for 2006 and 2013 (Table 6). The under 5-age group was specifically analysed as these children would have benefited most since the introduction of the clubfoot programme. The overall number of children under 5 years of age requiring surgery dropped between 2006 and 2012. In particular the rate of complex clubfoot surgery (open posteromedial release or bony tarsal surgery) reduced from 75% (N=53) in 2006 to 47% in 2013 (Table 7).Since 2004, BCIH has made 2-4 surgical trips per annum to peripheral locations. In total 318 patients have been surgically treated by BCIH in Mzuzu, with a mean of 45 patients being treated per annum. During the tenth year of BCIH services, approximately 545 paediatric patients received operative treatment elsewhere, conducted by Government and other organisations. Most operations were performed by resident surgeons at the Daeyang Luke Hospital, Lilongwe (200 patients), Kamuzu central hospital in Lilongwe (274 patients) and the remainder performed by visiting surgeons (71 patients) [2]. Thus a total of 1154 paediatric orthopaedic operations were known to have taken place in Malawi during the 10th year of operational services with 53% of cases being performed at BCIH.BCIH played a pivotal role in the re-establishment and coordination of the Malawi National clubfoot program since 2007. At present there are 4 central clubfoot clinics, 23 district level clinics (all districts covered), and 2 health centre level clinics, which combined, have treated 5748 patients since 2007. BCIH's contribution to teaching has resulted in the full postgraduate training of 2 orthopaedic surgeons and partial training of 3 orthopaedic surgeons now working in Malawi. Furthermore, BCIH provides placements and training for 2 Malawian orthopaedic surgical trainees, and they oversaw the training of Orthopaedic Clinical Officers (OCOS) with 72 trained over 6 years. Since 2009, clinical officer's training has been based at Queens Elizabeth Hospital, Blantyre. However, the clinical officers still undertake a clinical training placement at BEIT CURE. The surgeons working at BEIT CURE also participate in clinical officer training through active involvement with the educational programme undertaken at Queen Elizabeth Hospital and also act as examiners for the clinical officers exams. BCIH provides 3 annual Malawi theatre nurse fellowships, 2 regional African theatre nurse fellowships, mandatory rotation through BCIH for all Malawi Medical College students, rotational attachments for Kamuzu College of Nursing students, and rotational attachments for Rehabilitation technician trainees. Numerous training courses have been co-coordinated and run by BCIH, including 8 AO theatre nurse, 4 national orthopaedic ward nursing courses, 1 AO principles for surgeons course, 1 regional hip replacement course, 1 regional knee replacement course for surgeons, 1 physiotherapy and splinting course, and numerous Ponseti club foot refresher courses.

Discussion

At 5 years the clinical service provided by BCIH was reviewed and measured in terms of children operated, quality of care delivered, geographical coverage, range of operative interventions provided and impact on medical and allied specialty education. It was observed that one centre would not be able to provide all operative paediatric orthopaedic services for the nation, and that the impact of training and support for other centres would be strategic in the future. The number of paediatric orthopaedic operations performed at BCIH actually increased in the study period, despite global austerity and provision of more operations by other providers in Lilongwe, the capital of Malawi located in the central region. BCIH is situated in Blantyre in the southern region of Malawi. Therefore it is not unexpected that there is likely to be a natural bias towards treatment of southern patients. This bias was noted at 5-years with 48% of operatively treated case hailing from the south. A further increase has been seen over the last 5 years to 59%. One explanation may be that with 87% of the Malawi population living in central and southern regions [2] that these areas simply have a greater Orthopaedic workload due to difference in local population size. Bias towards treating more Southern patients may also have arisen from the fuel crisis in the nation during the study period. Increasing focus of services at BCIH on the Southern region is likely compounded by increased orthopaedic capacity throughout Malawi. During the tenth year of BCIH services, approximately 545 paediatric patients received operative treatment elsewhere. This represents an appropriate response to the findings of the 5-year review and the need to broaden capacity to stimulate paediatric orthopaedic services nationwide. Mkandawire et al[4] reported that 82 clinical officers trained through CURE and Queens are still in clinical practice. Of these 82 clinical officers 5 were working in Lilongwe, 5 in Mzuzu and 36 in district hospitals throughout Malawi with at least 1 clinical officer resident in every government organisation in Malawi. This wide spread nature of surgeons and clinical officers trained by CURE and Queens could explain the reduced activity of CURE in northern and central regions due improvement in local services. However we cannot fully quantify this and is therefore a limitation of the study. BCIH played a key role in re-establishing, supporting, and allocating funding to the MNCP with the aim of establishing a treatment centre in each of Malawi's district hospitals. Alongside the Ministry of Health and other partners BCIH helped to develop and coordinate the Malawi National clubfoot program since 2007. This has resulted in a progressive shift towards a national based approach to the management and treatment of children with orthopaedic problems.When compared with the 2012

population reference bureau figures which showed that Southern Region has the highest population of 6.7 million (45 percent), Central Region, 6.3 million (42 percent) and Northern Region, 1.9 million (13 percent) clubfoot services appear to be well spread throughout the regions[2].At BCIH the 5 most common diagnoses have remained static since the 5th year of service in 2006. Clubfoot procedures were the most common operative treatment at both 5th and 10th years. Gender distribution of clubfoot surgery has remained unchanged at 5 and 10 years. This was not unexpected as idiopathic clubfoot has a well-documented preponderance to male sex (>2:1). It has been hypothesis as a result of increased susceptibility and polygenic mode of inheritance[5] independent of social or geographical factors[6,7].In the 5th year study it was estimated that a decade of successful Ponseti treatment would be needed before a reduction in operative clubfoot workload would be seen. After 5 years we may be starting to see the effects of Ponseti with the overall percentage of clubfoot work falling from 15% to 13%. It is difficult to accurately quantify the true effect of the clubfoot programme. Patients in older childhood may not have benefited from treatment through the clubfoot program as infants, either prior to its inception or in the early stages. Therefore surgeries performed in this age group cannot be deemed an accurate marker of the success or failure of the clubfoot program. This may account for the reasonably small drop in overall numbers.However when the under 5 age group considered in isolation the rate of complex operative intervention for clubfoot (posteriomedial release) has dropped from 75% to 47% since introduction of the MNCP and could be considered a marker of success of MNCP. As expected the rate of percutaneous tenotomy and tibialis anterior transfer doubled. This should not be considered a marker of failure of the MNCP but a recognised requirement in many appropriately treated children. Ponseti et al6 reported a percutaneous tentomy rate of 80% as part of primary treatment regime and subsequent tibialis anterior transfer to prevent recurrence of heel varus in 40%. Burn contracture was the 2nd most common operation in 2006 and has fallen to 3rd in 2013. This is possibly due to increased awareness of the general public and public health safety drives currently active in Malawi. Commonly burns are obtained within the home environment, from cooking equipment and liquid. However it is clear that more education and training is needed to help reduce this preventable national health problem, which is a major cause of disability throughout Malawi. BCIH has made a significant contribution to training over the last 10 years. The OCO program was first introduced in 1985 by Dr Edward Blair. Between 1985 and 1995 six courses were held which trained a total of 45 OCOs. After 1995 Dr Blair left Malawi and the project halted largely due to lack of funding. In 1998, Prof Chris Lavy helped gain funds to support and maintain the training of OCOs between 1998 and 2007. In total BCIH funded, hosted and provided training and tutors for 72 OCO in the period 2002-8. In 2008 the Ministry of Health took over funding the program, which has now relocated to the College of Health Sciences to run alongside the Anaesthetic Clinical Officer training program. It was reported in 2008 by Mkandawire et al that since starting in 1985 117 OCO have been trained with 82 still in clinical practice and a resultant clinical officer to population ratio of 1:159,000.[4] Malawi has around 10 full-time Orthopaedic surgeons of whom 2 had their full training sponsored through BCIH, and 3 had part of their training sponsored by the hospital. BCIH has continued to provide a high quality of care over the last 10 years and currently employs five surgeons of whom three have completed the regional College of Surgeons of East central and Southern Africa Orthopaedic Fellowship. Two of these surgeons obtained the gold medal prize in their final surgical exams for obtaining the highest mark, demonstrating the high caliber of surgical training to be expected at the BCIH. Over the last ten years BCIH have also hosted 8 AO operating room personnel courses, which have been attended by approximately 200 operating theatre nurses from Malawi. This has provided the support for the operating theatre teams who engage with the surgeons in the nation's Central hospitals. In addition BCIH provides training placements for both medical students and nurses with 3 nurses from Lilongwe, Mzuzu and Blantyre completing a theatre nurse fellowship and all medical students from Malawi College of Medicine completing a placement at BCIH during their training. Such training is essential to the development of capacity in health care workers in the nation. Furthermore, BCIH has been involved in research into musculoskeletal conditions in Malawi and has played an active role in more than 50 publications in peer reviewed scientific journals.

Conclusion

Since our last report some changes are identified in the population group treated at BCIH, with a corresponding increase in decentralized paediatric orthopaedic surgical services – particularly to Lilongwe. Whilst the type of training placement offered at BCIH has varied over time, the priority placed on training has remained. The strategic impact of long-term training commitments is now being realized, in particular by the addition of Orthopaedic surgeons serving the nation BCIH continues to provide a remarkably high level of care in a time of global austerity. Not only has this charitable organization maintained its level of function it has in fact expanded its services – often through partnerships-into outreach centers throughout Malawi identifying patients in rural communities who desperately need orthopaedic intervention in order to become a functional member of society. BCIH has also taken on a national responsibility for orthopaedic clinical excellence and led by example, welcoming as many healthcare trainees as possible to help reduce the burden of physical disability throughout Malawi.

References

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Table 1: Sex distribution in 5th and 10th operative year

Sex	5th operative year (N=563) Number (%)	10th operative year (N=609) Number (%)
Female	224(40)	242(40)
Male	339(60)	367(60)

Table 2: Districts and region summary of patient's origin for 10th operative year

District	Number (609)
Northern	**(34)**
Chitipa	2
Karonga	5
Likoma	0
Mzimba	12
Nkata bay	14
Rumphi	1
Central	**(198)**
Ntcheu	23
Ntchisi	2
Salima	19
Dedza	14
Dowa	26
Kasungu	6
Mchinji	2
Lilongwe	77
Nkhotakota	29
Southern	**(359)**
Balaka	18
Blantyre	137
Chikwawa	24
Chiradzulu	17
Machinga	15
Mangochi	19
Mulanje	31
Mwanza	12
Nsanje	11
Thyolo	37
Phalombe	7
Zomba	30
Neno	1
Mozambique	17
Zimbabwe	1

Table 3: Comparison of patient origin by region for 5th and 10th operative years.

Region	5th Operative year (N=563)	10th Operative year (N=609)
	Number (%)	Number (%)
Northern	56 (10)	34 (5.6)
Central	199 (35)	198 (32.5)
Southern	269 (48)	359 (59)
Mozambique/Zimbabwe	32 (6)	18 (2.9)
District unknown	7 (1)	0

Table 4: Top 12 diagnosis in 2006 and 2013

Rank	5th Operative year		10th Operative year		
	Diagnosis	Number (%)	Rank	Diagnosis	Number (%)
1	Clubfoot	79 (15)	1	Clubfoot	76 (13)
2	Burn contracture	70 (12)	2	Genu Valgus	72 (12)
3	Genu Varus	58 (10)	3	Burn contracture	66 (11)
4(=)	Genu Valgus	45 (8)	4	Chronic Osteomyelitis	57 (9)
4(=)	Chronic Osteomyelitis	45 (8)	5	Genu Varus	37 (6)
6	Syndactyly	18 (3)	6	Cleft lip	30 (5)
7	Polydactyly	16 (3)	7	Polydactyly	29 (5)
8 (=)	TB	14 (2)	8	Cerebral Palsy	24 (4)
8 (=)	Cerebral Palsy	14 (2)	9 (=)	Osteogenesis imperfecta	17 (3)
10	Perthes disease	12 (2)	9 (=)	Blount's	
11	Windswept deformity	11 (2)	11 (=)	Syndactyly	16 (3)
12	Pseudarthrosis tibia	8 (1)	11 (=)	Congenital upper limb bony deficiency	15 (2)

Table 5: Age Distribution in 5th and 10th operative years.

Age Range	5th operative year (N=563) Number (%)	10th operative year (N=609) Number (%)
0 to 5	283 (50)	257 (42.3)
6 to 11	171 (30)	197 (32.4)
12 to 17	109 (19)	142 (23.4)
18+	6 (1)	12 (2)

Table 6: Age distribution of clubfoot surgery in 2006 and 2013

Age Range	Clubfoot surgery 2006 (N=100) Number (%)	Clubfoot surgery 2013 (N=76) Number (%)
0 to 5	71(71)	45 (59)
6 to 11	20 (20)	23 (30)
12 to 17	9 (9)	7 (9)
18+	0 (0)	1 (1)

Table 7: Breakdown Clubfoot surgery under 5s

	Clubfoot Surgery 2006 (N=71) Number (%)	Clubfoot surgery 2013 (N=45) Number (%)
Complex surgery	53 (75)	21 (47)
Tenotomy/ tendon transfer	18 (25)	24 (53)

Table 8: Breakdown of clubfoot clinic numbers by region

Clinic Name	District	Total number of Patients
Southern		**2517 (44%)**
Nsanje	Nsanje District	117
Chikhwawa	Chikhwawa	103
Cure Hospital	Blantyre	1156
Mwanza	Mwanza	97
Neno	Neno	101
Thyolo	Thyolo	96
Mulanje	Mulanje	156
Phalombe	Phalombe	83
Zomba	Zomba	178
Liwonde	Machinga	122
Balaka	Balaka	91
Mangochi	Mangochi	173
Monkey-Bay	Mangochi	44
Central		**2297 (40 %)**
Ntcheu	Ntcheu	139
Dedza	Dedza	168
Bwaila	Lilongwe	946
Mchinji	Mchinji	245
Kasungu	Kasungu	224
Salima	Salima	141
Nkhotakota	Nkhotakota	239
Dowa	Dowa	88
Ntchisi	Ntchisi	107
Northern		**934 (16%)**
Chintheche	Nkhata-Bay	95
Nkhata-Bay	Nkhata-Bay	73
Mzuzu	Mzuzu	266
Mzimba	Mzimba	104
Rumphi	Rumphi	147
Karonga	Karonga	156
Chitipa	Chitipa	93