

## **A 15 year survey of Burmese amputees**

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### **Abstract**

A 15-year retrospective study of 2228 civilian amputees was conducted at the Hospital for the Disabled, Thamaing, Rangoon. It was demonstrated that utilization of appropriate technology for development of essential components had enabled the hospital to serve more amputees. The ratio of male to female was 4.23 : 1. The mean age was 31 years, male slightly older than female. Trauma was the leading cause of upper limb amputations (87%). In the lower limb although trauma (47%) was the prominent cause, disease (41%) was a close second. Major specific causes of trauma were gun-shot/explosion (25%), railway accident (20%) and road accident (19%). Leading specific causes of disease were leprosy (25%), vascular disease (24%) and gangrene (23%). Unless appropriate and effective preventive measures are instituted man-power drainage and demand for prosthetic services will continue.

### **Introduction**

When the Hospital for the Disabled was established in Rangoon, in January 1960, prosthetic-orthotic services were introduced for the first time in Burma. Initially, while the administration of the hospital was under the Ministry of Social Welfare, services were provided only to the veterans of World War I and II. Later in January 1965, when the hospital's administration was transferred to the Ministry of Health, the services were also extended to the civilian population.

The purpose of this retrospective study was to investigate the epidemiology and general characteristics of the amputees to assist in

future planning of prosthetic services and to identify the possible venues that could contribute towards attainment of Health for All by the Year 2000.

### **The study**

Since its inception the hospital maintained an Amputee Intake form, for all new admissions, recording the common vital characteristics dealing with age, sex, height, weight, and educational, marital and vocational status. In addition, the onset and date of amputation, cause and site of amputation were obtained, the length, shape and condition of the stump and range of joint motions were described. It also included information on prosthetic prescription, duration of prosthetic fabrication, status of check-out and overall period of prosthetic rehabilitation.

The present study covered only a period of 15 years, from January 1969 to December 1983, as data collected prior to this consisted mostly of war veterans and very long-standing amputees. Data analysed in this study was limited to those related to number, age and sex of amputees; educational, marital and vocational status; and level and cause of amputations with particular relationship to different age groups and vocational status. Three periods of 5 years were considered, as much as possible, in the statistical analysis.

### *Number of amputees*

The total number of amputees was 2228. There had been a sharp increase (31%) of admissions during the second period "74-78" and thereafter the increment was slight (2%) (Table 1).

### *Age*

The youngest amputee admitted was 4 months and the oldest was 80 years of age for

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Table 1. Number of amputees admitted in different periods

Periods	Number of Amputees			Percent	Percent Rise
	Male	Female	Total		
69-73	496	116	612	27.47	
74-78	653	148	801	35.95	+31
79-83	653	162	815	36.58	+ 2
Total	1802	426	2228	100.00	

the whole period. During each period, however, the oldest had gradually risen from 74 years to 80 years.

The mean age of amputees for the whole period "69-83" was 31. Male slightly older than female which remained almost constant for all three periods (Table 2).

When the ages were analysed in five specific groups (Table 3), the greatest number of amputees fell within the 21-40 age group (42.73%) and immediately followed by 11-20 (24.24%) and 41-60 (23.70%) age groups. If different age groups were considered for each period there was a rise of nearly 3% each in 21-40 and above 61 age groups at the expense of other groups.

#### Sex

Among the 2228 amputees there was a strong preponderance of 1802 males (80.88%) compared with 426 females (19.12%). The overall male to female ratio was 4.23 : 1 and remained fairly constant in all three periods (Table 1).

On comparing the sex distribution within the specific age groups, there were more females in the younger age groups. The ratio of male to

Table 2. Mean age in different periods

Sex	Periods			Total 69-83
	69-73	74-78	79-83	
Male	31	32	33	32
Female	26	31	27	28
Whole group	30	32	32	31

Table 3. Distribution of age groups in different periods

Age groups	Periods			Total
	69-73	74-78	79-83	
below 10	47	37	43	127 (5.70%)
11-20	157	194	189	540 (24.24%)
21-40	251	345	356	952 (42.73%)
41-60	145	196	187	528 (23.70%)
above 61	12	29	40	81 (3.63%)
Total	612	801	815	2228 (100.00%)

female was 0.70 : 1 and 2.80 : 1 in below 10 and 11-20 age groups, respectively (Table 4).

#### Education status

On admission the majority of amputees 66.03% (None-14.68% and Read & Write-51.35%) had little or no education. Only 10.46% had passed the middle school and a few completed high school (2.37%) (Table 5).

#### Marital status

A high percentage of amputees were unmarried (53.55%) and (39.27%) were married at admission (Table 6). Married males were proportionately higher than married females. Pre- and post-amputation marital status of both sexes were insignificant.

Table 4. Male to female ratio in each age group

Age groups	Periods		
	69-73	74-78	79-83
below 10	1.63	1.30	0.70
11-20	3.50	3.60	2.80
21-40	5.30	7.10	5.80
41-60	5.80	4.55	6.15
above 61	5.00	1.40	3.40

Table 5. Education status of amputees

Education Status	69-73	74-78	79-83	Total
None	115	114	88	327 (14.68%)
Read & Write	305	408	431	649 (51.35%)
Passed Primary School	131	164	176	471 (21.14%)
Passed Middle School	52	93	88	233 (10.46%)
Passed High School	9	22	22	53 (2.37%)
Total	612	801	815	2228 (100.00%)

*Vocational status*

As the majority of amputees were dependents on admission an attempt was made to identify their occupation at the time of amputation or onset. It was revealed that 701 were dependents (31.46%) (including 274 congenital amputees), followed by 464 labourers (20.83%), 376 cultivators (16.88%), 261 students (11.71%), 245 self-employed (11.00%) and 181 managerial personnel (8.12%). Most of the labourers were seasonal and semi-skill workers. Policemen and office workers were included in the managerial group. Dependents consisted of housewives, monks (clergy) and unemployed. However, although

Table 6. Marital status of amputees

Marital Status	69-73	74-78	79-83	Total
Single	343	425	425	1193 (53.55%)
Married	234	308	333	875 (39.27%)
Widow/Widower	23	44	36	103 (4.62%)
Divorced/ Separated	12	24	21	57 (2.56%)
Total	612	801	815	2228 (100.00%)

Table 7. Vocational status of amputees

Vocational Status	69-73	74-78	79-83	Total
Cultivator	71	147	160	376 (16.88%)
Labourer	141	135	189	464 (20.83%)
Managerial	39	70	68	181 (8.12%)
Self-employed	74	92	82	245 (11.00%)
Student	82	119	60	261 (11.71%)
Dependent	206	238	257	701 (31.46%)
Total	612	801	815	2228 (100.00%)

students were dependents they were classified separately for statistical purposes. When the two extreme periods were compared, the cultivators rose by 8% and students fell by 6% (Table 7).

*Levels of amputation*

Among the 2228 amputees there were 1684 lower limb (75.58%), 436 upper limb (19.57%) and 108 multiple limb (4.85%) amputees, the ratio being 15.59 : 4.04 : 1. Multiple limb amputees had bilateral, one sided, triple and quadruple limb involvements.

The levels of amputation are indicated in Table 8. The commonest variety was below-knee (49.42%); followed by above-knee (20.87%), below-elbow (8.48%) and above-elbow (6.64%) amputations.

The age distribution of 436 upper limb amputees is shown in Table 9. Fifty-six percent (244 amputees) were in 21-40 age group and next was 11-20 age group with 112 amputees (25.69%).

When the age distribution of 1684 lower limb amputees was analysed (Table 10), here also the majority of amputees were found in the 21-40 age group (39.31%). Next was 41-60 age group (26.90%) and third was 11-20 age group (23.34%).

The predilection for left and right side

Table 8. Levels of amputation

Levels of amputation	Number	Percent
<b>UPPER LIMB</b>		
Shoulder disarticulation	25	1.12
Above-elbow	148	6.64
Elbow disarticulation	15	0.67
Below-elbow	189	8.48
Wrist disarticulation	59	2.65
Sub total	436	(19.57)
<b>LOWER LIMB</b>		
Hip disarticulation	14	0.63
Above-knee	465	20.87
Knee disarticulation	44	1.98
Below-knee	1101	49.42
Syme	60	2.69
Sub-total	1684	(75.58)
<b>MULTIPLE LIMB</b>		
(Sub-total)	108	(4.85)
Grand Total	2228	100.00

Table 9. Age distribution of upper limb amputees

Age groups	Levels of amputation					Total	
	S/D	A/E	E/D	B/E	W/D	Number	Percent
below 10	—	6	1	9	1	17	3.90
11–20	10	36	4	50	12	112	25.69
21–40	11	88	9	102	34	244	55.96
41–60	4	17	1	27	11	60	13.76
above 61	—	1	—	1	1	3	0.69
Total	25	148	15	189	59	436	100.00

Table 10. Age distribution of lower limb amputees

Age groups	Levels of amputation					Total	
	H/D	A/K	K/D	B/K	Syme	Number	Percent
below 10	3	12	9	69	5	98	5.82
11–20	7	129	12	231	14	398	23.34
21–40	2	190	14	433	23	662	39.31
41–60	2	122	8	305	16	453	26.90
above 61	—	12	1	63	2	78	4.63
Total	14	465	44	1101	60	1684	100.00

amputations was almost equal in the lower limb amputees. In the upper limb amputees, however, the left side involvement was 8% higher than the right side (Table 11). This may be due to a high incidence of sword-cut injuries to the upper limb, resulting from fights and quarrels, where the victims tend to protect with the left upper limb.

#### *Causes of amputation*

Trauma (55.25%) was the leading cause of amputation, followed by disease (32.45%) and congenital (12.30%). Trauma (87.16%) was the main cause of upper limb amputations. In the lower limb amputations both trauma (46.73%) and disease (40.74%) appeared to be almost equally responsible. Out of 108 multiple limb amputees trauma was the cause for 59%. In congenital, lower limb amputees (77.01%) were most predominant (Table 12).

Specific causes of trauma were considered under "railway", "road" and "domestic/farm/industrial" accidents; and "gun-shot/explosion"

Table 11. Side of amputation

Side	Upper limb	Lower limb	Total
Left	234 (54%)	846	1080
Right	202 (46%)	838	1040
Total	436 (100%)	1684	2120

Table 12. Causes of amputation

Causes	Upper limb	Lower limb	Multiple limb	Total
Disease	22 (5.04%)	686 (40.74%)	15 (13.89%)	723 (32.45%)
Trauma	380 (87.16%)	787 (46.73%)	64 (59.26%)	1231 (55.25%)
Congenital	34 (7.80%)	211 (12.53%)	29 (26.85%)	274 (12.30%)
Total	436	1684	108	2228 (100.00%)

and "sword-cut" injuries. Farm and industrial accidents were actual work related injuries, whereas domestic accidents were those sustained by individuals falling from trees and huts/houses, and injuries received during pursuit of their personal livelihood. Gun-shot/explosion injuries were not combat oriented except those incurred by policemen.

Specific causes of disease were considered under "gangrene", "bone and joint infection", "leprosy", "tumour" and "vascular disease". "Gangrene" consisted essentially of diabetics, those resulting from prolonged application of tourniquet after snake-bite and other non-traumatic unspecified causes. Bone and joint

Table 13. Specific causes of amputation by age groups

Causes	Age groups					Total
	<10	11-20	21-40	41-60	>61	
<b>DISEASE</b>						
gangrene	—	18	36	83	26	163
bone & joint infection	4	18	36	42	11	111
leprosy	—	8	86	75	13	182
tumour	1	26	38	25	3	93
vascular	1	6	82	79	6	174
Sub-total	6	76	278 (38.45%)	304 (42.05%)	59	723
<b>TRAUMA</b>						
railway	12	111	87	32	7	249
road	5	63	110	55	6	239
domestic/farm/ industrial	9	97	185	61	1	353
gun-shot/explosion	2	68	176	54	7	307
sword-cut	1	9	57	15	1	83
Sub-total	29	348 (28.27%)	615 (49.96%)	217	22	1231
<b>CONGENITAL</b> (Sub-total)	92 (33.58%)	116 (42.34%)	59	7	—	274
<b>GRAND TOTAL</b>	127	540	952	528	81	2228

infection was usually tuberculous in the young and those diagnosed as osteomyelitis. The latter were chronic sufferers consequent to inadequate management received after minor wounds or cuts. The most dominant pathology in "vascular disease" was thrombo-angiitis obliterans affecting particularly the males of working age.

Specific causes of amputation analysed against five different age groups are shown in Table 13. Among 1231 trauma amputees the 21-40 age group (49.96%) was most affected. The leading specific cause, in this age group, was domestic/farm/industrial accident (30%), closely followed by gun-shot/explosion (29%).

Among 723 disease amputees the 41-60 age group (42.05%) was primarily involved, followed by 21-40 age group (38.45%). Within the 41-60 age group the specific causes of amputation, were, gangrene (27%), vascular disease (26%) and leprosy (24%). Whereas in 21-40 age group the prevalent specific causes were leprosy (31%) and vascular disease (29%). Congenital amputees usually came forward for assistance between 11-20 years of age (42%) and before 10 years of age (34%).

Specific causes of amputation analysed against six different vocational groups are indicated in Table 14. In trauma, 330 labourers (26.81%) were most affected but only 42%

Table 14. Specific causes of amputation by vocational groups

Causes	Vocational groups						Total
	Cultivator	Labourer	Managerial	Self-employed	Student	Dependent	
<b>DISEASE</b>							
gangrene	28	28	11	32	8	56	163
bone & joint infection	33	5	7	20	6	40	111
leprosy	27	29	11	29	5	81	182
tumour	18	10	10	13	18	24	93
vascular	28	62	35	32	2	15	174
Sub-total	134 (18.53%)	134 (18.53%)	74	126	39	216 (29.88%)	723
<b>TRAUMA</b>							
railway	22	36	12	39	86	54	249
road	21	76	17	31	43	51	239
domestic/farm/ industrial	76	137	13	20	58	49	353
gun-shot/explosion	84	67	57	23	29	47	307
sword-cut	39	14	8	6	6	10	83
Sub-total	242 (19.66%)	330 (26.81%)	107	119	222 (18.03%)	211	1231
<b>CONGENITAL</b> (Sub-total)	—	—	—	—	—	274	274
<b>GRAND TOTAL</b>	376	464	181	245	261	701	2228

were due to domestic/farm/industrial causes the remainder were from other traumatic causes. Two hundred and forty-two cultivators (19.66%) were the next victims of trauma but they were more prone to gun-shot/explosion (35%) than to farm accidents (31%). Out of 222 students (18.03%), the third largest group of traumatic amputees population, 39% were susceptible to railway accidents.

In disease, 216 dependents (29.88%) were the primary victims and the leading causes were leprosy (38%) and gangrene (25%). The next, equally common victims were 134 cultivators (18.53%). Cultivators were more prone to bone and joint infection (25%), followed equally by gangrene and vascular disease (21% each) and leprosy (20%). Labourers were most susceptible to vascular disease (46%).

### Discussion

The total number of amputees reported did not include members of the armed services and civilians who were unable to come forward for socio-economic reasons. The increase of 31% in amputees, during "74-78", may be attributed to more liberal admissions; because from 1976 the hospital was able to produce SACH type natural rubber prosthetic feet, capable of wearing traditional slippers, and socket and ankle blocks from locally available Ye-ma-nay wood (*Gmelia arborea*).

The overall male to female ratio was 4.23 : 1 (Table 1). Female amputees had progressively increased during the three periods in the below 10 and 11-20 age groups (Table 4). In the former the females exceeded the males, as in India (Narang & Jape, 1982); probably because parents were anxious to have their daughters treated early to avoid future untoward consequences. In the latter, probably because young girls in the rural areas, who were seasonal cultivators and dependents, and traditionally fetched water and vegetables, were frequently injured by anti-personnel land mines sown by insurgent-terrorists around water sources and vegetable patches. The mean age of the amputees was younger (Table 2), in the early 30s, than in Hongkong (Chan et al, 1984). Unlike Hongkong the males were slightly older than the females.

The ratio for upper limb to lower limb amputations was 1 : 3.86 (Table 8). Therefore, upper limb amputees were far less than either in

India or Hongkong. Trauma was the leading cause of upper limb (87%) and multiple limb (59%) amputations. In the lower limb although trauma (47%) was the main cause of amputation disease (41%) was a close second (Table 12). Most traumatic amputations occurred in the 21-40 age group (50%); whereas "Disease" affected more in the 41-60 age group (42%) and to some extent in 21-40 age group (38%) (Table 13).

The high incidence of 353 domestic/farm/industrial accidents (28.68%) (Table 14) incurred by 185 amputee in the 21-40 age group (Table 13) need not be blamed on industrialization. In this accident group there were only 76 cultivators (22%) and 137 labourers (39%). Even the injuries sustained by these vocational groups were not entirely confined to their occupation, as some of them were injured by domestic activities undertaken during their free time. Therefore, it was evident that cultivators were more susceptible to gun-shot/explosion, labourers to road accident, students to railway accidents and dependents were prone to all types of accident (Table 14).

Disease was responsible for 723 amputations (32.45%), leading age groups affected were 41-60 (42%) and 21-40 (38%). Gangrene was the main cause of amputation in the 41-60 age group (27%). If the 21-40 and 41-60 age groups were considered together leprosy as well as vascular disease affected them with equal intensities (Table 13). Leprosy prevailed in the dependents but this could be misleading (Table 14), because the high incidence of lepromatous amputees in the 21-40 age group would suggest, that due to the chronicity of their condition, many were transformed to dependency from other vocations.

The majority of the causes of amputation are preventable and may be reduced by appropriate primary and secondary preventive measures. Therefore, it is extremely important to evolve procedures for early detection of leprosy and diabetes mellitus, to ensure adequate treatment coverage and health education in diet and care of anaesthetic hands and/or feet; instructions in first-aid for minor injuries and cuts, road, railway and domestic accidents; and to encourage early referral of congenital amputees. For these procedures to be effective, innovative community-based approaches should be employed as 80% of the population

are rural inhabitants. For successful achievement inter-sectorial co-operation is also essential. In addition, research is needed to investigate the cause and prevalence of thrombo-angiitis obliterans in high starch consuming young males. Preventive measures for gun-shot/explosion accidents is beyond the scope of this discussion.

Until these interventions are timely and appropriately instituted drainage of manpower and demand for prosthetic service will continue. To make prosthetic service affordable there will be need for training and further development of simple, functional, durable and acceptable prosthetic components.

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