

## **Retrospective study of 14,400 civilian disabled (new) treated over 25 years at an Artificial Limb Centre**

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### **Abstract**

This paper reports on 14,400 civilian disabled treated over 25 years at the Artificial Limb Centre, Pune, India. It examines in some detail sex and age distribution, cause of disability, levels of amputation, sources of payment and other factors relating to the rehabilitation of the patient.

### **Introduction**

Rehabilitation of the disabled is a vital problem not only for the Armed Forces but also for the nation at large; apart from war injuries, accident and disease also produce large numbers of disabled.

An awareness of the importance of the ultimate rehabilitation of the patient is a marked feature of modern surgical practice and bio-medical engineering. It is now an accepted principle that the surgeon's responsibility extends beyond the operating table and that of the engineer beyond the workshop to the point where the return of the patient to more or less normal activity becomes a reality.

### **The Artificial Limb Centre Pune**

The Artificial Limb Centre was established in 1944 with the help of experts from Roehampton, London, primarily to look after disabled veterans of the Second World War. From 1954 onwards, facilities were gradually extended to civilians.

It is a unique and pioneer institution in India, in that it is not just a factory manufacturing artificial limbs, but an establishment where total care for the patient is provided from the time

long before an artificial limb is required to his rehabilitation programme.

The Artificial Limb Centre incorporates a hospital of 200 indoor beds. The staff consists of surgeons, medical officers, paramedical personnel, engineers and technicians; total staff strength is 350 to 400.

Amputations, review amputations, tendon and joint surgery to correct deformities, plastic and reconstructive surgery etc. are carried out by the surgeons of this centre.

Along with the fabrication of artificial limbs, practice in their use is commenced in a very well equipped physiotherapy and rehabilitation department.

The centre is self-sufficient. The materials used for manufacture of limbs and appliances are indigenous and the various components are manufactured locally in the centre.

### **The study**

During the last 25 years (from 1954 to 1978) a total of 14,400 civilian amputees and other orthopaedically handicapped persons were treated at this centre. This is more than twice the number of disabled soldiers and ex-Servicemen treated during the same time span.

Records are maintained for every case and recently a study was undertaken to analyse the civilian cases and compare them with other studies available in the literature.

Male patients comprise 88.37% of the total, and females 11.63% (Fig. 1 and Table 12). The reasons for male predominance or unequal distribution may be:

(1) Men have a more outdoor life and are thus more exposed to trauma.

(2) Indian society being male dominated, the bread winners are mostly males, therefore disabled males get preference for treatment over disabled females in the family.

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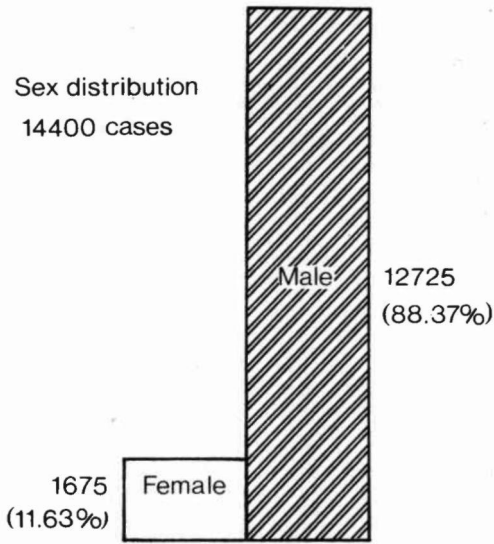


Fig. 1. Sex distribution in 14,400 cases.

However it will be noted that female children up to 10 years of age form almost one-third of the number of male children; probably parents are keen to have their daughters treated, otherwise deformity will be a great handicap in grown-up girls.

Most of the patients are in the age groups 10-20, 20-30 and 30-40 (Fig. 2). Young children are very active at this age and find new activity outside the home. Similarly, young adults are either seeking jobs after completing education or are holding jobs, and are more prone to accident.

Table 1. Cause of disability, 14,400 cases

Trauma	9,649	(67%)
Disease	3,930	(27.3%)
Congenital	821	(5.7%)

The major cause of disability is trauma, 67%, followed by disease 27.30%, and congenital 5.70% (Table 1). It is interesting that females form 25% and 30% respectively of the disease and congenital groups, but only 4.6% of the traumatic group.

Railway, vehicle and factory accidents form the largest group, 87% (Fig. 3). Recently, due to modernization, cases of electric shock and accidents with farm implements such as threshers etc. have considerably increased.

A large proportion of accident victims are in their most promising and productive phase of life and their disablement causes a great blow to their families and the community. Indian

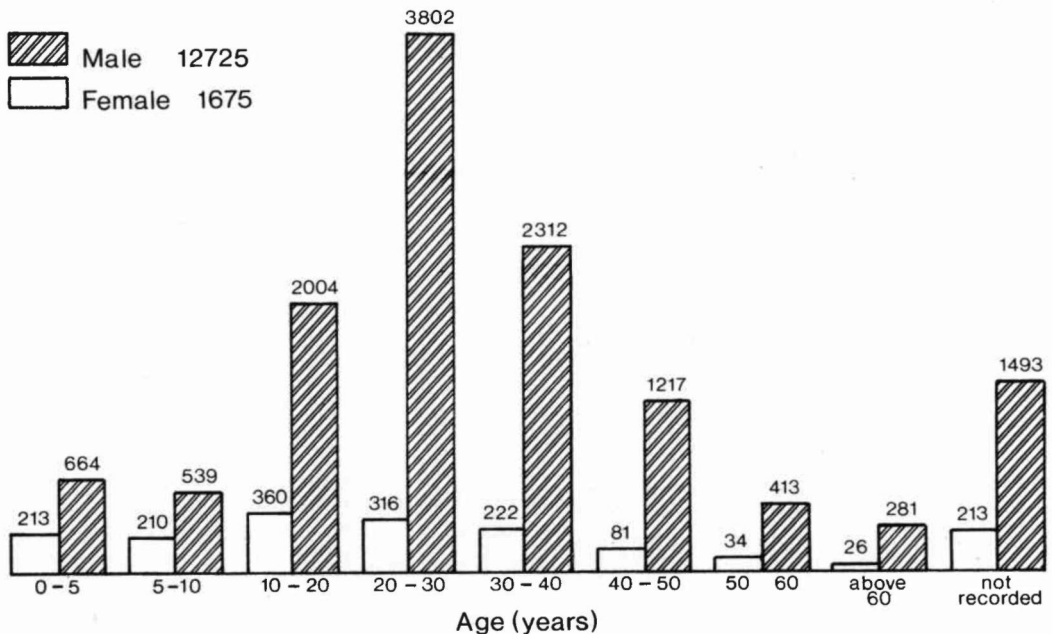


Fig. 2. Age distribution in 14,400 cases.

families are very closely knit so that, in spite of the economic problems caused by a disability, the victim does not suffer a great loss of status or socio-economic isolation in the family or community.

Table 2. Types of disease in 3,930 cases

Poliomyelitis	1,346	(34.25%)
Thromboangiitis obliterans	993	(25.27%)
Malignancy	339	(8.62%)
Diabetes	251	(6.40%)
Other*	1,001	(25.46%)

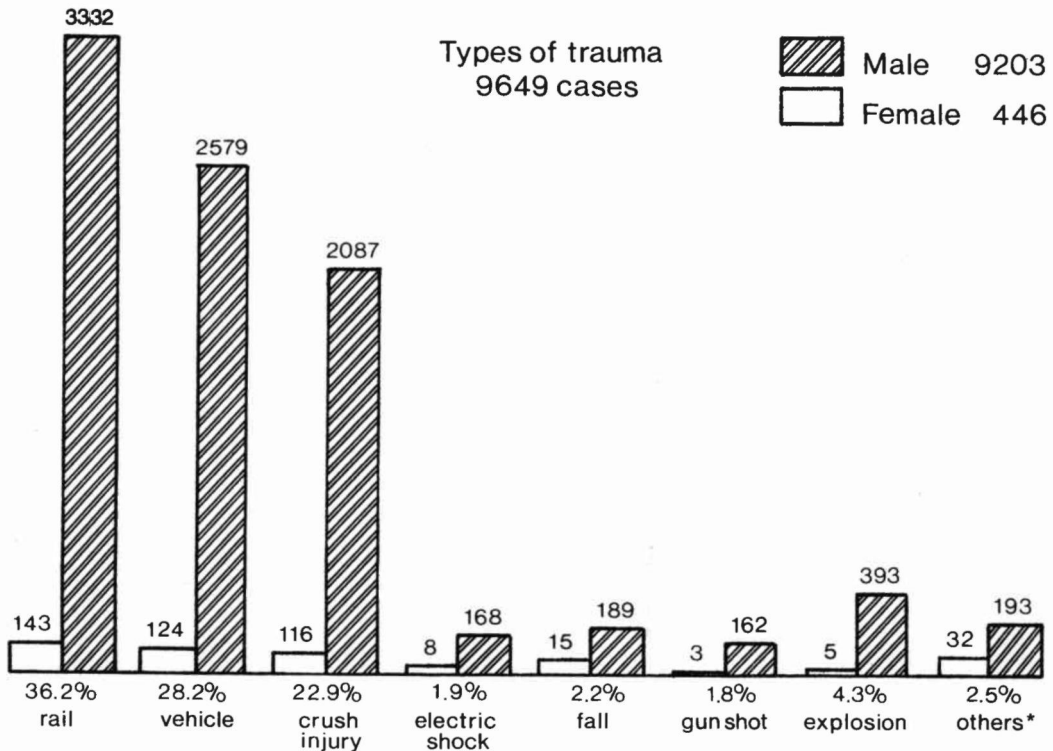
\*Caries spine, leprosy, osteomyelitis, sacroiliac strain, prolapsed disc, scoliosis, lumbago, motorneuro disease, paralysis, hemiplegia, paraplegia, hernia, spastic paresis, tumour, chondroma, cervical spondylosis, spondylosthesis, etc.

Vascular disease was the main reason for amputation in the older age group; the main cause of deformity, mostly in children under 10 years of age, was poliomyelitis (Table 2). These

children, especially from villages, were usually brought to the Centre late when deformities were gross and making orthoses was difficult without major and repeated surgical procedures. Cancer strikes at all ages, but the cases in the study were mostly below 30 years of age and their amputations were either through hip or above-knee.

Table 3. Congenital deformities

		Male	Female	Total
Lower limb	R	103	50	153
	L	116	32	148
	Bil	90	33	123
Upper limb	R	14	15	29
	L	15	17	32
	Bil	4	8	12
Foot deformities	R	20	9	29
	L	33	9	42
	Bil	93	64	157
Other		41	—	41
Total		529	237	766



\* Stab wounds, burns, animal bites, etc.

Fig. 3. Types of trauma in 9,649 cases.

Table 4. Congenital deficiencies

	Male	Female	Total
Lower limb	15	14	29
Upper limb	27	15	42
Multiple	2	1	3
Total	44	30	74

While phocomelic deformities were more common in the upper limb than the lower limb, the great majority of congenital deformities affected the lower limb and foot (Table 3). Males suffered almost double the number of upper limb deficiencies but an equal number of lower limb involvements (Table 4). Only three cases of multiple deficiencies were noted in this series.

Rehabilitation of the congenitally disabled is comparatively easy, because being born with a limb deficiency or deformity forces the child to make automatic adjustments to his surroundings and to his psychological environment. These children have usually developed ingenious methods of compensating for their disabilities:

Table 5. Disability

	Male	Female	Total	
Amputation	10,648	844	11,492	(80%)
Deformity	2,077	831	2,908	(20%)
Total	12,725	1,675	14,400	

Eighty per cent of the cases were of amputation and the remaining 20% of deformity (Table 5). Females comprised only 7.3% of the amputees but 28.5% of those with disability due to deformity.

The proportion of people with deformities, congenital or otherwise, coming for treatment has more than doubled in recent years. This shows a growing tendency to seek treatment for the less obvious disabilities which previously were tolerated without treatment. A child with a foot or leg deformity would drag itself around and the parents accept the disability as a stroke of ill-luck. If the child was not totally bed-ridden, nothing further would be done. The general attitude towards health was that health meant an apparent absence of disease or illness. It was a negative concept of health which suggested that if one was not actually in bed, one was healthy.

With a growing awareness about health matters, this attitude is giving way to a more positive approach, ie that health is not merely an

apparent absence of illness but functioning of the body and the mind at their full efficiency, using their potential to the fullest. This changing attitude encourages the seeking of help for the avoidance and correction of minor or less obvious illnesses and disabilities so that the body can attain its optimum in efficiency and is reflected in the increased proportion of deformities coming for treatment.

Table 6. Amputations

	Male	Female	Total	
Lower limb	6,580	552	7,132	(62%)
Upper limb	3,974	276	4,250	(37%)
Miscellaneous	94	16	110	(1%)
Total	10,648	844	11,492	

Lower limb amputations were the most numerous, 62%, while upper limbs were 37% and those involving both limbs 1% (Table 6). Recently, an upward trend of upper limb amputees was noted.

Lower limb amputations were mostly caused by railway and vehicle accidents while upper limb amputations were the result of machine, electric and explosives accidents.

Table 7. Lower limb amputations

	Right	Left	Total
Above-knee (including through-hip and through-knee)	1,508	1,509	3,017
Below-knee (including Syme and Chopart)	1,752	1,812	3,564
Bilateral			511
Total	3,260	3,321	7,092

Below-knee amputations accounted for 46.3% of all the lower limb amputations and above-knee for 37.6%. There was no marked difference between right and left (Table 7).

In bilateral cases 50% were below-knee followed by above-knee 20% and the remainder in various combinations.

Table 8. Upper limb amputations

	Right	Left	Total
Above-elbow	848	602	1,450
Below-elbow	922	667	1,589
Through-elbow, through-shoulder	151	131	282
Through-wrist, PMH	461	262	723
Bilateral			206
Total	2,382	1,662	4,250

Seventy per cent of upper limb amputations were performed at the preferred level of above and below-elbow (Table 8). The interesting observation is that the total number of right side amputees is almost 1½ times more than left side (2,382 to 1,662), the reason being that the right arm is used more than the left in any type of work.

Amputations at wrist level and partially mutilated hand form 17% of this group. Bilateral cases account for 4.8%.

Rehabilitation is difficult for artisans and craftsmen and psychological problems are more pronounced. It has not been possible so far to provide a functional hand with moving fingers.

Below-elbow amputations form the biggest group in bilateral cases.

In the first six months after disability only 12.6% of patients reported for treatment but this increased to 31.8% within one year. However, 32.5% did not report for treatment until more than four years after disability (Fig. 4).

The reason for the small number reporting within six months may be that in the case of amputation, the stump needs time to stabilize

before limb fitting and in polio much time is spent on initial physiotherapy.

The time lag is now reducing because of an increasing awareness and motivation and also improved availability of rehabilitation service, but amputees are still reporting earlier than patients with deformities. The obvious reason is that polio etc, occurring in early childhood or at birth, forces adjustment and mobility when the patient is at a more flexible age and less conscious of social stigmas. Also, the physical presence of limbs is sometimes more reassuring to the patients and parents therefore there is less inducement to go for treatment.

In cases of trauma, the sudden and dramatic physical loss of limbs is unsettling in the extreme. It shatters the body image of the victim and reduces his self esteem to an alarmingly low level. Therefore the psychological effects of amputation are more dramatic and incapacitating to the victim's ego and to his social relationships. Thus the patient and his immediate family have a powerful motive for seeking early treatment.

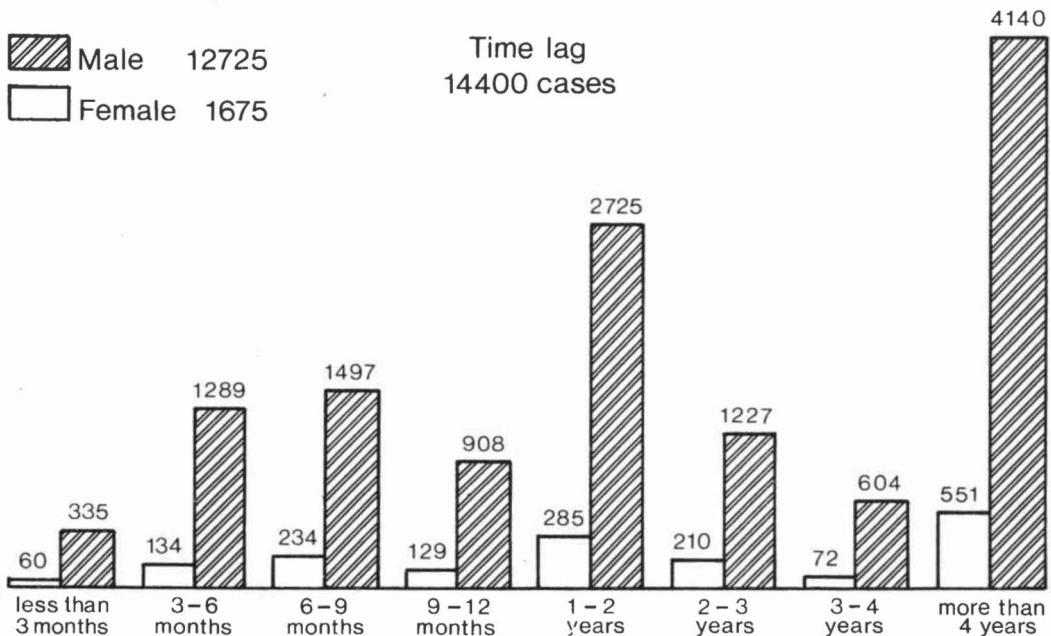


Fig. 4. Time lag in reporting for treatment, 14,400 cases.

Table 9. Sources of payment

Individual	10,258	(71%)
Government agencies	1,867	(13%)
Employer	1,719	(12%)
Voluntary agencies	556	(4%)
<b>Total</b>	<b>14,400</b>	

Seventy-one per cent of patients pay for their own treatment while 25% are paid for by their employers and Government agencies (Table 9). Voluntary agencies such as the Red Cross, Lions Club, Rotary Club and similar other organizations help in only about 4% of cases.

Table 10. Inpatients and outpatients

	Male	Female	Total
Inpatients	5,939	469	6,408 (44.5%)
Outpatients	6,786	1,206	7,992 (55.5%)
<b>Total</b>	<b>12,725</b>	<b>1,675</b>	<b>14,400</b>

Eleven per cent more outpatients than inpatients are seen at the Centre (Table 10). Patients from the local State make up about 20% of the total while 80% come from other States.

Seventy-five per cent of patients stay between 3 and 12 weeks, bilateral amputees staying longer than unilateral amputees. Only about 13% who undergo corrective surgery stay longer than 12 weeks.

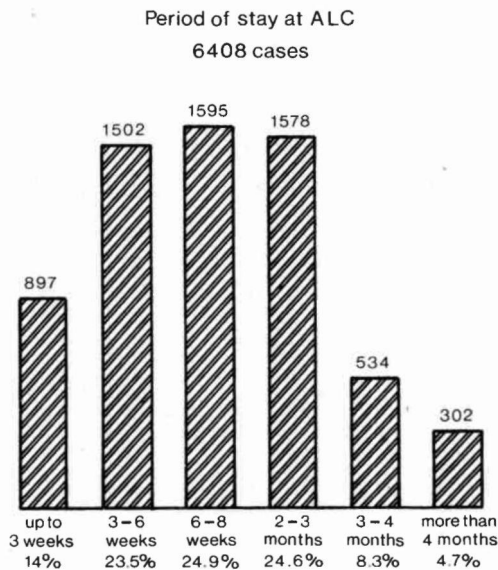


Fig. 5. Period of stay at the Artificial Limb Centre, 6,408 cases.

Only 14% of patients stay for less than 3 weeks, these are patients who are given priority for compassionate reasons.

Table 11. Number of issues to date (25 years)

No. of issues	Upper limb	Lower limb	Orthoses
1	3,526	5,334	2,877
2	249	1,119	188
3	51	493	83
4	38	296	27
More than four	1	114	4
<b>Total</b>	<b>3,865</b>	<b>7,356</b>	<b>3,179</b>

It was found that more lower limb amputees return for limb renewal than upper limb amputees (Table 11). The obvious reason is that lower limb prostheses are functionally and psychologically more satisfying than upper limb prostheses and receive more use.

### Comparison with other studies

In this series, the traumatic group is the largest so far reported (Table 13), while the disease, congenital and tumour groups are small—either patients do not come forward for treatment as they are reconciled to fate, or the number affected is low.

Table 12. Sex ratio

	Present study	Munson and Dolan (1968)	Pellicore et al (1974)
Male	12,725	2,287	327
Female	1,675	1,708	132
<b>Ratio</b>	<b>8 : 1</b>	<b>1.5 : 1</b>	<b>2.5 : 1</b>

Table 13. Reason for amputation

	Disease	Trauma	Tumour	Congenital
Present study 1954-1978	20.3%	76%	3%	0.7%
Kegel et al (1976) 1964-1976 Lower extremity	49%	35%	8%	7%
Glattly (1964) 1961-1963 Upper and lower extremity	58%	33%	5%	4%
Kay & Newman (1974) 1973-1974 Upper and lower extremity	70%	22%	5%	3%
Kerstein et al (1974) 1961-1971 Lower extremity	85%	7%	3%	5%
Davies et al (1970) 1965-1967 Upper and lower extremity	37%	50%	4%	8%

Table 14. Cause of accidents

	Present study	Dept. of Veterans Affairs (1978)	Pellicore et al (1974)
	Vehicle	28% (3.8% female)	24% (36% female)
Industrial	22%	11%	16%
Train & farm	36%	10%	20.5%

The high incidence in this study (Table 14) may be due to fast industrialization, modernization of farms and fewer preventive and safety measures.

Table 15. Side affected

	Present study		Munson and Dolan (1968)	
	R	L	R	L
Upper limb	2,482	1,147	721	1,008
Lower limb	3,260	3,321	778	705

There is definite evidence of the right arm being injured more often than the left in this series (Table 15) as compared to other reported series.

### Conclusions

1. The ratio of males to females seeking treatment at ALC is very high, i.e. 8:1.
2. The major cause of amputation in India is trauma due to vehicle, train, machinery and farm accidents.
3. Right arm amputees are almost double in number to left.
4. The majority of patients pay for their own prostheses.
5. The majority report late for treatment.
6. Lower limb prostheses are renewed more often than upper limb prostheses.

7. The average life of a prosthesis is about 5 years.

8. The average hospitalization or absence from work is about 8 weeks for manufacturing, fitting and prosthetic training.

9. Both poliomyelitis and accidents, which produce the maximum number of disabled in India are preventable.

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