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Amputee population in the Kingdom of Saudi Arabia

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Abstract

A 14 year retrospective study was conducted of 3210 amputees who attended during the period 1977-1990 at Riyadh Medical Rehabilitation Centre (RMRC), the first and the largest rehabilitation centre in the Kingdom of Saudi Arabia. The mean age was 30.5 years, male slightly older than female. The mean age of the lower limb amputees was 32.6 and of the upper limb amputees 21.8 years. An overall predominance of male to female with a ratio of 6.1:1 was observed. Males outnumbered females by 5 to 1 in the upper limb and 6.3 to 1 in lower limb amputees. The ratio of lower limb to upper limb and multiple limb amputees was 15:3.7:1. Trauma was the leading cause of upper limb amputations (86.9%). In the lower limb, although trauma (52.9%) was the prominent cause, 35.9% was due to disease. Major specific causes of trauma were road traffic accidents, machine accidents, and falls from height. The most common site of unilateral amputations was trans-tibial (45.2%), followed by trans-femoral (21.6%), trans-radial (7.6%), partial hand (4.8%), and trans-humeral (4.7%). Comparison with other studies shows a higher mean age and fewer trans-tibial amputees than in Autralia and other Western countries, while studies in Asia show greater similarities to the present investigation as regards trauma and disease incidence which occur in similar patterns. These patterns of amputee population indicate the demand for prosthetic service and provide guidelines for future development.

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Introduction

Prosthetic and orthotic services were introduced into the Kingdom of Saudi Arabia in 1974 with the establishment of the Riyadh Medical Rehabilitation Centre (RMRC). For a number of years, it was the only place to which all amputees from all over the Kingdom were referred for prosthetic management. Amputees represented 15.2% of the total number of cases attending the centre during the 1977-1990 period (Fig. 1). Prostheses are provided at no cost to citizens, residents and amputees from the neighbouring countries.

Extensive studies of amputees and their fitting with prostheses have been made in different parts of the world. Glattly (1964) conducted a survey of 12,000 new amputees over the 1961-1963 period in the USA and found a predominance of trans-humeral amputees among the lower limb prosthesis

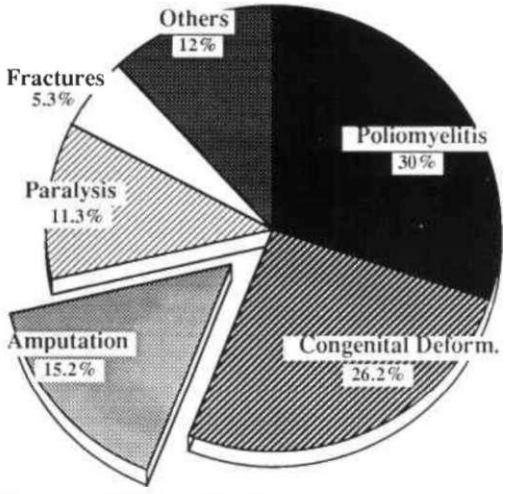

Fig. 1. Incidence of different cases during the 1977-1990 period.

users. Twelve years later in their study Kay and Newman (1975) found that the number of trans-tibial amputees presenting for prosthetic fitting had increased to 53.9% in the USA. Many studies have reported high percentages of amputation due to disease. Warren and Kihn (1968), in a 1964 study of Veterans Administration Hospitals, reported that 76% of the amputations were for vascular insufficiency. Vascular disease and infection were the reasons for amputation in 98% of the 172 cases between 1964 and 1968 reported by Burgess (1969). Of 194 cases 85% were found to be due to vascular disease in a study by Kerstein (1974), and 95% of 292 trans-tibial amputations reported by Murray (1965). Hansson (1964) reported 85% lower limb amputations for peripheral vascular disease in 586 amputees in Sweden from 1947 to 1963. Pohjolainen and Alaranta (1988) reported that during the 1984-85 period, there were 880 amputations of lower limbs performed on 705 patients in Southern Finland. Patients in this study requiring amputation were arteriosclerotic in 43.1% of cases and diabetic in 40.7%. The most common site of unilateral amputation was trans-humeral (42%) followed by trans-tibial (27.7%) and toe amputation (22.2%). In Denmark, Ebskov (1983) also reported that the combined share of arteriosclerotic and diabetic gangrene consistently accounted for more than 85% of all lower limb amputations and the changes within each aetiology, including trauma, were not statistically significant. Jones (1977 and 1990) stated that in Australia most amputees who had lost their lower limbs had amputation due to peripheral vascular disease. In another study by Katrak and Baggott (1980), it was shown that trans-tibial amputation was more common than trans-humeral amputation in Australia. Jones (1989) also found that trans-tibial prostheses made up to 58.7% of all prostheses prescribed under the free limb schemes in Australia (1981-1985). Children were predominant users of Syme's and trans-radial prostheses. A five-year review of referrals to 23 disablement services centres for prosthetic treatment in England, Wales and Northern Ireland (1981-1985) by Ham *et al.* (1989) showed a decrease in the number of both upper and lower limb referrals and a 4% increase in arteriosclerosis as the primary cause of amputation.

Pohjolainen and Alaranta (1988) reported that trauma was the most common cause of upper limb amputation in Southern Finland between 1984-85. Trauma was also the main cause for upper limb amputation which represented 3% of all major amputations in Denmark between 1978 and 1983 as reported by Andersen-Ranberg and Ebskov (1988).

Other studies published from India, Hong Kong and Burma showed a different pattern. Chan *et al.* (1984) presented results of a 24 year retrospective study of 1,821 amputees treated by the prosthetic and orthotic unit of the Kowloon Rehabilitation Centre in Hong Kong and demonstrated a rising trend of amputee populations with a 1.88:1 ratio of lower limb to upper limb amputees. The mean age was 39 years. The commonest cause of upper limb amputation was trauma, and of lower limb amputation was disease. A study in Burma by Hla Pe (1988) found that trauma was the leading cause of upper and lower limb amputations (87% and 47% respectively) though disease was a close second in lower limb amputations. The studies in Asia had great similarities to each other, as trauma and disease incidence occur in similar patterns, whereas the patterns are different in America, Denmark, Finland and Australia.

The disability following limb amputation is permanent and can also be enormous: in many cases amputation makes the patient heavily dependent on other people. The amputee requires considerable in-patient and out-patient care and frequently makes demands upon the social services and welfare workers. Every attempt must be made to return the individual to as near normal functional status as possible and to his original environment. However, the services which plan and organize the provision of prostheses and rehabilitation for amputees would benefit from information concerning the extent of the problems, which obviously differ from one country to another. To the authors' knowledge, no major study has previously been carried out in Saudi Arabia on the population of amputees and prosthesis users.

The current investigation presents the data for a fourteen year period from 1977 to 1990 on amputees and prostheses prescribed for them through RMRC mainly to identify the incidence, causes and levels of upper and lower limb amputations. However, the primary purpose of this retrospective study is to

investigate the current epidemiological situation and assess general characteristics of amputees for the planning of prosthetic rehabilitation and for better evaluation of future needs in personnel, facilities and funds.

Methodology

RMRC had maintained patient forms, for all new cases, recording the common vital characteristics dealing with age, sex, the onset and date of amputation, and causes and levels of amputation. In addition, the educational, marital and vocational status were recorded. Forms on the length, shape and condition of the stump and ranges of motion were recently included. Also included was information on prosthetic prescription, date of prescription, duration of prosthetic fabrication, status of check-out and overall period of prosthetic rehabilitation.

Every patient's record was examined identifying any data concerning demographic factors and general characteristics. Then the data from these forms were processed and entered into a microcomputer-system (Apple Macintosh SE/30), using a data management software (Microsoft File). For scientific investigation, individual researchers and medical institutions may be provided with information according to their speciality and needs. Naturally a certain set of rules must be applied in order to safeguard the privacy of the amputees.

The current study looks at data from 1 January, 1977 to 31 July, 1990 on amputees and the prostheses prescribed, fabricated and fitted at RMRC. Data analysed in this investigation were mainly limited to those related to the number, age and sex of amputees; educational, marital and vocational status; and the level and cause of amputation, and their respective relationship to different age groups and vocational status.

Results

Number, age, and sex

During the 1977-1990 period, the total number of amputees was 3,210. There has been a general increasing trend in new cases since 1981 (Fig. 2). Among the 3,210 amputees, there were 75.9% lower limb, 19% upper limb and 5.1% multiple limb amputees, the ratio being 15:3.7:1. Multiple limb amputees had bilateral, one-sided or triple limb involvement.

The mean age of amputees was 30.5 years, but the distribution ranged from less than 1 to 95 years of age. Male amputees had a slightly higher mean age than females (31 and 28.5 years respectively). The mean age of lower limb amputees was 32.6 years. The mean age of upper limb amputees was 21.8 years. When the age distribution was studied it was found that

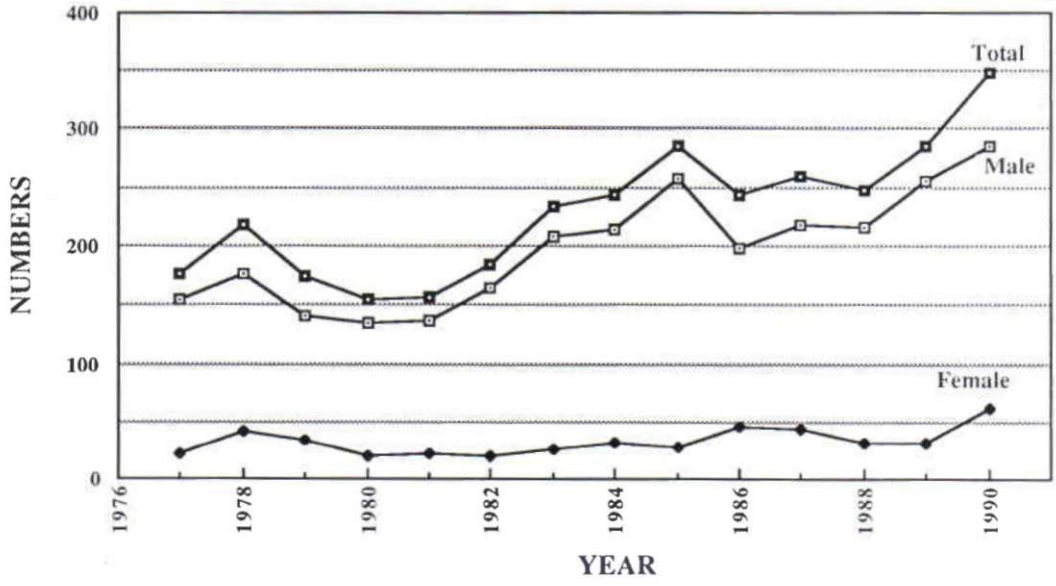

Fig. 2. Number of new amputees presenting during the 1977-1990 period.

the greatest number of amputees were less than 10 years of age (19.5%), immediately followed by the 11-20 age group (18.5%) and the 21-30 (18.1%); while those between 31-40 (12.6%) formed the fourth majority group (Fig. 3).

There was a strong preponderence of males (85.8%) compared with females (14.2%). The overall male to female ratio was 6.1:1. On comparing the sex distribution within the specific age groups, several interesting features were identified. Among the younger amputees of 10 years or below, the ratio of male to female was 3.2:1, compared to the overall pattern of 6.1:1. This was immediately followed by an increase in the ratio of male to female in the 11-20 and 21-30 age groups (12.5:1 and 18.3:1 respectively). A sudden decline in the predominance of males started with the 31-40 age group (5.7:1) and continued up to the 51-60 age group (3.9:1). The peak of male predominance (19.3:1) was reached in the 71-80 age group.

Causes of amputation

The causes of amputation are categorized into four groups: congenital, tumour, disease, and trauma. The data indicated that the majority of amputations were due to trauma (59.7%). The next most common causes were disease (30.1%), tumour (5.5%), and congenital (4.7%) (Table 1). Specific causes of trauma were classified, in order of frequency, as road traffic accident followed by machine accident and fall from height.

Table 1. Causes of amputation

Causes of amputation	Upper limb	Lower limb	Multiple limb	Total
Trauma	530	1289	97	1916 *(59.7%)*
Disease	36	876	54	966 *(30.1%)*
Tumour	6	170	—	176 *(5.5%)*
Congenital	38	102	12	152 *(4.7%)*
Total	610	2437	163	3210 *(100%)*

Specific causes of amputation, as analysed against ten different age groups, are shown in Table 2. Among the trauma amputees, the 11-20 age group (25.8%) was most affected and closely followed by the 21-30 age group (25.6%). The leading specific cause in the 11-20 and 21-30 age groups was road traffic accident (57.4% and 51.5% respectively), followed by machine accident (14.8%) in the 21-30 age group, while the second main cause, in the 11-20 age group, was war injuries (10.4%). Amputation resulting from disease was greatest

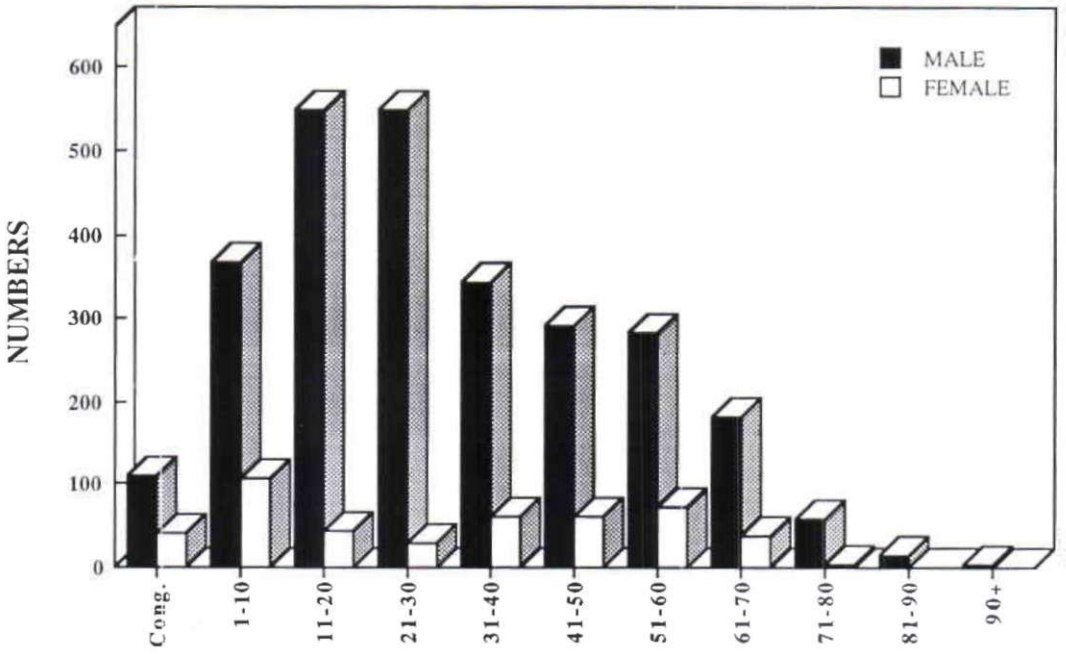

Fig. 3. Different age groups and sex among the amputees.

Table 2. Percentage of amputation due to tumour, trauma, and disease by age

Age group	Trauma %	Disease %	Tumour %
<10	21.5	6.3	3.4
11-20	**25.8**	5.9	**22.4**
21-30	25.6	6.6	19.0
31-40	14.3	11.0	12.1
41-50	7.9	16.0	20.7
51-60	3.3	**27.6**	19.0
61-70	1.0	19.4	3.4
71-80	0.6	5.3	—
81-90	—	1.6	—
>90	—	0.3	—
	100%	100%	100%

in the 51-60 age group (27.6%), followed by 61-70 age group (19.4%), with 54.2% being found in the combined over 50 age groups.

The percentage of amputation owing to tumour was largest in the 11-20 age group (22.4%), which is similar to that found in the survey in USA by Glattly (1964). The percentages in the 41-50 and 51-60 age groups (20.7% and 19% respectively) were much higher than in the 61-70 age group (3.4%).

Amputation in males by reason of trauma was 10 times as frequent as in females, while congenital deformities of the limbs that were fitted with prostheses occurred with a 2.7:1 male to female ratio (Table 3).

Levels of amputation

There were 2,437 (75.9%) lower limb, 610 (19%) upper limb, and 163 (5.1%) multiple limb amputees, the ratio being 15:3.7:1. The

Table 3. Ratio of male to females by cause of amputations

Cause of amputation	Males	Females	Ratio (Males:Females)
Trauma	1741	175	10:1
Tumour	143	33	4.3:1
Disease	760	206	3.7:1
Congenital	111	41	2.7:1
Total	2755	455	6:1

Table 4. Levels of amputation

Levels of amputation	Number	%
Upper limb		
Shoulder disarticulation	18	0.6
Trans-humeral	152	4.7
Elbow disarticulation	15	0.5
Trans-radial	243	7.6
Wrist disarticulation	27	0.8
Partial hand	155	4.8
Subtotal	610	19
Lower limb		
Hindquarter	6	0.2
Hip disarticulation	9	0.3
Trans-femoral	694	21.6
Knee disarticulation	94	2.9
Trans-tibial	1452	45.2
Ankle disarticulation	49	1.5
Partial foot	133	4.2
Subtotal	2437	75.9
Multiple limb		
Bilateral upper limb	17	0.5
Bilateral lower limb	136	4.3
Upper and lower limb	10	0.3
Subtotal	163	5.1
Grand total	3210	100%

levels of amputation are indicated in Table 4, the commonest variety being trans-tibial amputation (45.2%); followed by trans-femoral (21.6%), trans-radial (7.6%); and trans-humeral (4.7%) and partial hand (4.8%) amputations. The predilection for the left side (55%) was higher than for the right side (45%) in the lower limb amputees, while the right side (53.6%) involvement was 7% higher than the left side (46.4%) in the upper limb amputees.

Upper limb amputees

Of the 3,210 amputees, 19% were upper limb amputees. Trans-radial amputees are the largest single group, comprising 39.8% of all upper limb amputees. Partial hand amputees formed the second largest group (25.4%). Trans-humeral amputees are the next most frequent group. They formed 24.9% of the upper limb amputees, with a mean age of 23 years. Shoulder disarticulation formed ony 2.9%, followed by elbow disarticulation amputees 2.5%. Trauma was the main cause of the upper limb amputations (88.8%), of which 26.8% were due to machine accident.

The mean age of upper limb amputees was 21.8 years. The highest age was a 63-year-old male. 23.6% were in the 21-30 age group and immediately next was the 11-20 age group (21.6%). 72.6% of upper limb amputees were below 30 years of age; unlike the lower limb amputees, of whom only 52% were below the age of 30. There were only six upper limb amputees over 60 years of age at time of amputation in the fourteen year period. Children below 10 years (27.2%) composed the highest percentage of the trans-tibial amputees. This is because trans-tibial limb deficiency is the commonest congenital upper limb defect in children and accounts for 76.9% of all congenital upper limb amputations.

Lower limb amputees

Among the 3,210 amputees, there were 2,437 (75.9%) lower limb amputees. Of the lower limb amputees, trans-tibial represented 59.6% which was the most common site, followed by trans-femoral (28.5%) and partial foot (5.5) amputees. When the age distribution of lower limb amputees was analysed, a different picture was revealed compared with upper limb amputees. Of all lower limb amputees, 52% were under 30 years of age, while 11.3% were over 60. The commonest age group was the 21-30 group (17.5%), followed by the 11-20 age group (17.2%). In lower limb amputation, trauma (52.7%) was also the main cause of amputation, followed by disease (35.9%). The majority of lower limb amputations owing to trauma related to road traffic accidents (67%).

Multiple limb amputees

Multiple limb amputees had bilateral, one-sided or triple limb involvements. Among the 3,210 amputees, there were 163 (5.1%) multiple limb amputees, including only 3 females. The mean age was 28.6 years. Bilateral upper limb amputees were 17 in number (10.4% of the multiple limb amputees). All those cases were male with bilateral trans-radial amputation due to trauma. Most bilateral lower limb amputees (83.4%) had either trans-tibial amputation (69.4%) bilaterally, or trans-femoral amputation on one side and a trans-tibial amputation on the other side (14.3%). Only 10 (6.1%) amputees had one trans-radial amputation combined with a trans-tibial or trans-femoral amputation. The common age groups of the multiple limb amputees was the 11-20 (23.4%) group and those less than 10 years of age (22.2%). In multiple limb amputations, trauma was the main cause.

Educational, vocational, and marital status

On admission, a high percentage of amputees had little or no education and could be considered illiterate (47.4%) and 20% had an elementary level of education, while 5.5% had completed a university degree. Children below school age constituted only 3.7%.

On admission, the majority of amputees were married (65.8%). Married males (88.7%) presented a higher proportion than married females (11.3%). The pre and post-amputation marital status of both sexes was not available on the forms.

Regarding the vocational status of the amputees on admission, a high percentage were labourers (23%), followed by the retired (19.6%) then clerical workers (17.5%) and students (16.7%). When specific causes of amputation were analysed against different vocational groups, it was evident that labourers were most affected by trauma constituting 28.8% of the cases. Only 19.8% of them were affected by machine accidents, whereas the remainder were the victims of road traffic accidents. Students formed the second largest group of the traumatic amputee population (21%), just over 57% of them victims of road traffic accidents. Clerical workers were the next largest group of victims of trauma (19.3%). They were also more prone to road traffic accidents, which claimed 59.8% of them, Retired persons were the primary victims of disease (59.8%) and the leading cause was gangrene (80.7%). The next most common victims of disease were housewives (16.9%), closely followed by clerical workers (16.6%).

Discussion

The total number of amputees reported here includes all those who received prostheses from RMRC during the 1977-90 period only. Since it was for a long time the only place to which all amputees from all over the Kingdom were referred, this investigation reveals, to a certain extent, the vital characteristics related to age, sex, onset and date of amputation, cause and site of amputation, and the educational, marital and vocational status of the amputee

population in the Kingdom; thus allowing some nationwide conclusions to be drawn from the presented results.

On looking at the total number of new amputees presenting annually at RMRC (Fig. 2), we notice a general upward trend from 1977-90 with a remarkable and steady rise in the numbers of amputees in the 1980-85 period, probably related to the well-known spurt of rapid growth and industrialization occurring during this period. The subsequent decline in the next period 1986-88 was related to the diversion of a significant proportion of the amputee population to new regional prosthetic and orthotic centres which were developed as part of the expansion programme in medical services in the Kingdom.

The overall male to female ratio was 6.1:1. This is seen to be because males are more susceptible to amputation due to road traffic accidents and work accidents than women who are not permitted to drive and are rarely employed. Women are also less likely to seek prosthetic management. The number of female amputees increased sharply during various intervals. There were three such periods in 1978/79, 1986/87 and 1990, when they increased to over 20% of the total number of amputees. The male sex proportion of lower limb amputees is higher than in upper limb amputees, the male to female ratio being 6.4:1 and 4.9:1 respectively. The ratio for upper limb to lower limb amputations was 3.87:1. Thus the proportion of upper limb amputees was far less than their proportion either in India or Hong Kong, and similar to the ratio in Burma.

The mean ages of upper limb amputees, 21.8 years, and lower limb amputees, 32.6 years, were younger than in earlier reported studies on Western countries and similar to the mean ages in the studies in Asia. This reflects the predominantly younger age pattern of the Saudi population and the effect of the increasing incidence of traumatic amputation. Consequently, the number of traumatic amputees using prostheses would be expected to increase in future studies, as the present amputees will live a normal life span and continue to use lower limb prostheses. Trauma was the leading cause of amputation of upper and lower limbs in both sexes (affecting 59.7%). In lower limb amputations, although trauma was the main cause of amputation (52.7%), disease accounted for more than one-third (36%) of the lower limb amputees. Most traumatic amputations occurred in the 11-20 and 21-30 age groups, affecting 25.8% and 25.6% respectively; while disease affected more in the 51-60 age group (27.6%) and, to some extent, in the 61-70 age group (19.4%). This investigation has also revealed a significant difference in proportion between right and left side amputations in the upper and lower limbs. Amputations resulting from trauma are expected to occur more frequently in the dominant limb, especially upper limb amputations.

The overall trans-tibial to trans-femoral ratio was 2.1:1. A comparison between the years 1977 and 1990 shows a decrease in trans-femoral amputation. In 1977, 29.5% of all amputations were trans-femoral and 52.3% trans-tibial. In 1990, there was a slight reduction in the percentage of trans-tibial (to 45.4%) and a great reduction in trans-femoral amputations (to 16.4%). This may be attributable to the fact that surgeons are now more aware of the importance of trying to save the knee on the affected side and the fact that elderly trans-femoral amputees may not have the fitness to learn to use a prosthesis and even those who have learned to use a prosthesis may not necessarily continue to use it because it is easier to use crutches or a wheelchair. All these factors decrease the prevalence of trans-femoral prosthesis users.

Ankle disarticulation amputees constituted only 2% of the lower limb amputees. There were only 6 amputees with Syme's prostheses under 10 years of age. Jones (1989) showed that this type of prosthesis was commonest in childhood, often used for congenitally limb deficient children. The Syme's amputation is performed as a treatment method for certain congenital abnormalities. It was noted from examining the data on individual children that frequently the child for whom a Syme's prosthesis was initially prescribed, later received a patellar-tendon-bearing (PTB) prosthesis. Thus such children comprised 5.4% of trans-tibial amputees who were supplied with total contact PTB prostheses. This may explain some of the decline in prescription numbers and individuals above the age of twenty. In adults, the Syme's amputation is used mostly after trauma. Some 50% of such amputations

occurred in the 11-40 age group; and there were no amputees over 60 years old, as expected, due to the fear concerning wound healing and blood supply problems in this age group.

Knee disarticulation amputees formed only 3.9% of lower limb amputees. Considering the excellent prostheses available to this group of amputees, the application of this type of surgery is surprisingly rare. Some 35% of the prescribed lower limb prostheses were fitted to children under 10 years who mainly had congenital anomalies that required amputation.

The peak occurrence (41.5%) in the 11-30 age group demonstrates the non-vascular cause of this amputation. Jensen and Mandrup-Poulsen (1983) reported that the statement that the knee joint should be preserved at any price seemed to be no longer valid, as patients with knee disarticulation amputations generally did better than trans-tibial amputees and the majority of trans-femoral amputees failed to achieve satisfactory gait. The high success rate following knee disarticulation has been pointed out by many studies (Early, 1968; Howard and Chamberlain, 1969; Chilvers *et al.*, 1971; Newcombe and Marcuson, 1972; Jensen and Mandrup-Poulsen, 1983; Houghton *et al.*, 1989). The explanation for the high success rate of knee disarticulation prostheses probably lies in the undisturbed strength of hip and thigh muscles, the end-bearing capacity of the stump and a feeling of stability and security in the socket. Another explanation might be that the prostheses can easily be supplied with a knee lock in case the patient demonstrates instability or incapacity in walking with a mobile knee joint. This is in contrast to a trans-tibial prosthesis, where a preliminary PTB or comparable prosthesis has to be exhanged for a conventional prosthesis with a knee lock in a similar situation. Based on these considerations, it is suggested that the knee disarticulation level of amputation should be selected in all possible instances as an alternative to a trans-femoral amputation, as the prosthetic fitting is highly superior. It is also suggested that the knee disarticulation level should be considered as an alternative to the trans-tibial amputation in all old and feeble patients if the postoperative fitting is likely to be problematic, as such patients are more likely to be able to walk on an artificial, although stiff, limb after knee disarticulation.

Among the upper limb amputees, trauma is the single commonest cause (88.8%). The majority of these injuries were related to road traffic accidents and occupational hazards. It is therefore not surprising to find in this study that the majority of upper limb amputees are relatively young, 72% of them having ages under 30 years. The same reason might explain the male and right-handed predominance.

This study has shown upper limb prostheses to be infrequently used in the Kingdom. This may relate partially to the infrequency of upper limb amputation and partially to the dissatisfaction experienced with upper limb prostheses. Sturup *et al.* (1988) reviewed 43 patients with unilateral traumatic amputations as to the use of prostheses and employment consequences of amputation and found that 17 of 19 trans-radial and 12 of 24 trans-humeral amputees used their prostheses. Non-users were characterised by: higher amputation level, non-dominant arm amputation and younger age at the time of amputation. They usually did well on the labour market. It has been shown that trans-radial prosthesis is commonest in children. Similarly, Jones (1989) found that trans-radial prostheses were the commonest upper limb prostheses, with children being the most frequent users. This is because trans-tibial limb deficiency is the commonest congenital upper limb defect in children.

In this study, the distribution of upper limb amputation over different age groups showed a characteristic pattern. From the age of one to ten years, the incidence is highest and can be attributed mostly to house accidents, since there were few congenitally limb deficient children. Thus, 27.4% of trans-tibial amputees were under ten years of age. Partial hand amputees were the second largest group of upper limb amputees, closely followed by trans-humeral amputees. The peak occurrence in the 11-40 age groups demonstrates the dominance of the traumatic cause of trans-humeral amputation.

When one reviews the developments of upper limb prostheses, it becomes quite apparent that, apart from externally powered prostheses, there have been no revolutionary changes. The hook remains the most universally used terminal device as it has been for several centuries. The electronic hand does not provide any more additional function to the

amputee, apart from the three-jaw chuck grip, which is not much different from the old mechanical hand. Possibly for these reasons, the rejection rate of prostheses by unilateral arm amputees still remains rather high.

The majority of the causes of amputation are preventable and may be reduced by appropriate primary and secondary preventive measures. Since, in Saudi Arabia, trauma is the leading cause of the amputation of upper and lower limb in both sexes, as revealed by this study, it is extremely important to improve medical care of traumatized limbs and to up-grade the safety measures of road traffic and work conditions. It is also possible that the need for amputation due to lower-limb ischaemia could probably be reduced by earlier detection and vascular surgical evaluation of arterial insufficiency (Larsson and Risberg, 1988). A review of amputation statistics by Jonsson *et al.* (1984) on amputations in diabetic patients in Gotland and Umea counties 1971-1980 showed a lower instance of amputation in Umea than in Gotland. They considered the lower frequency of amputations in Umea as probably the consequence of a restricted period of systematic search for early signs of gangrene, as part of the research programme.

The present study should be extended to other regional prosthetic and orthotic centres in order to get a panoramic view of the real need for prosthetic services. It is only through comprehensive surveys that reliable statistics may be obtained to make planning the provision of facilities and manpower for such services truly meaningful.

Summary

The following comments and observations on this statistical material are worthy of note.

1. The majority of amputees were below the age of 30 years and the proportion of male to female amputees was 6.1:1. Congenital deformities of the limbs that are fitted with prostheses occur with a 2.7:1 male to female ratio.
2. There was a surprisingly small number of amputees over 70 years of age who were fitted with prostheses. In this series, they numbered 77 or 2.5% of the total number of amputees. There was no patients over 70 years among upper limb amputees.
3. The leading cause of amputation was trauma for both lower limb (52.7%) and upper limb (88.8%). Amputation in males on account of trauma is more than 10 times as frequent as in females, whereas amputation due to disease is only 3.7 times as frequent in males as in females. This is due to the vocational and other hazards to which males are exposed.
4. The ratio between lower limb, upper limb and multiple amputations was 15:3.7:1. The commonest level of amputation in lower limbs was trans-tibial (59.6%) and in upper limbs trans-radial (39.8%).
5. There were 163 cases of multiple amputations, of which 17 were bilateral upper limb cases, 136 were bilateral lower limb amputations, and ten involved one upper and one lower limb.
6. The predilection for the left side was higher than for the right side in lower limb amputations, while the right side involvement was 7% higher than the left side involvement in the upper limb amputees.
7. The majority of amputations in Saudi Arabia are preventable if the citizens are taught to minimize the hazards to which their children are exposed in the home environment and on the road, and if the safety measures in road traffic and work conditions are effectively upgraded, with a greater medical care given to traumatized limbs and vascular problems of the lower limbs.

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