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Amputations in eastern Turkey (Van): a multicenter epidemiological study

Van bölgesindeki amputasyonlar: Çokmerkezli epidemiyolojik çalışma

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Amaç: Amputasyonların etyolojileri birçok faktöre bağlı olarak ülkelere ve bölgelere göre farklılık göstermektedir. Bu çalışmada, Van ilindeki merkezlerde yapılan amputasyonlar geriye dönük olarak incelendi ve bölgemizin coğrafi ve kültürel özelliklerinden kaynaklanan amputasyon nedenleri ortaya konmaya çalışıldı.

Çalışma planı: 1995-2005 yılları arasında Van ilindeki sağlık merkezlerinde toplam 440 hastada (345 erkek, 95 kadın; ort. yaş. 28.5; dağılım 3 ay-85 yaş) yapılan 475 amputasyon, hastaların yaş ve cinsiyeti, amputasyonun etyolojisi, taraf ve seviyesi ve uygulanan cerrahi girişimler yönünden geriye dönük olarak incelendi.

Sonuçlar: Yaş açısından en büyük grubu 21-30 yaş grubundaki olgular (n=109) oluşturuyordu. On yaş altı çocukların tüm hastalara oranı %13.4 idi. Amputasyonların 218'i üst ekstremitede (%45.9), 257'si alt ekstremitede (%54.1) uygulandı. Olguların 223'ünde sağ, 188'inde sol, 29'unda birden fazla ekstremite amputasyonu yapıldı. En yaygın amputasyon nedeni travma (n=177, %40.2) idi. Ateşli silah yaralanması (n=45), mayın (n=33) ve el bombası (n=7) patlamaları travmatik nedenler içinde ilk sırayı almaktaydı. Travma nedenli amputasyonları diyabet (n=86), doğuştan hastalıklar (n=33) ve periferal vasküler hastalık (n=30) nedeniyle yapılan amputasyonlar izlemekteydi. Bölgeye özgü amputasyon nedenleri olarak tandır fırını yanıkları (n=7), sınıkçı müdahalelerine bağlı yanlış uygulamalar (n=3) ve donma (n=3) gözlendi. Yirmi dört olguda replantasyon yapıldı ve bunların 15'inde (%62.5) başarı sağlandı.

Çıkarımlar: Bölgemizde ateşli silah yaralanması ve mayın patlamalarına bağlı travmatik amputasyonlar sık görülmektedir.

Anahtar sözcükler: Amputasyon/epidemiyoloji; ekstremite/yaralanma; Türkiye/epidemiyoloji.

Objectives: The indications for amputations vary among countries and different regions depending on many factors. This study was designed to evaluate amputations performed in the province of Van and to determine specific causes of amputations associated with geographical and cultural characteristics of the region.

Methods: A total of 475 amputations were performed in 440 patients (345 males, 95 females; mean age 28.5 years; range 3 months to 85 years) in medical institutions of Van between 1995 and 2005. The patients were evaluated with respect to age and sex, etiology, side and level of amputations, and surgical interventions performed.

Results: Amputations were the most common in the 21 to 30-year age group with 109 patients. Pediatric patients below the age of 10 years accounted for 13.4%. Of all the amputations, 218 (45.9%) involved the upper extremity, and 257 (54.1%) involved the lower extremity. Amputations were right-sided in 223, left-sided in 188 patients, and 29 patients underwent multiple amputations. Trauma was the most common cause of amputations (n=177, 40.2%), with leading etiologies as gunshot injuries (n=45), land mine (n=33) and hand grenade (n=7) blasts. Other frequent indications apart from traumatic causes were diabetes mellitus (n=86), congenital diseases (n=33), and peripheral vascular disease (n=30). Causes more specific to regional characteristics were tandoor burns (n=7), mistreatment by traditional bonesetters (n=3), and frostbites (n=3). Replantation was performed in 24 patients, of which 15 (62.5%) were successful.

Conclusion: Our region features gunshot injuries and land mine blasts as the most common traumatic causes of amputations.

Key words: Amputation/epidemiology; extremities/injuries; Turkey/epidemiology.

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Amputation is one of the oldest and most serious operations in history. Roman scientist Celcus[1] defined the amputation of a gangrenous extremity in detail in the 1st century. Regarding the approach to amputations, many things have changed since the era before modern medicine, when skin, muscle and bone were cut at the same level using 'classic circular cut' technique.[2] With the development of surgical and anesthetic techniques, the first aim has become to keep the viability of the extremity. If this aim cannot be realized, the extremity which has lost its functions and viability will lead to prolonged hospitalization, deterioration of health condition, and loss of any possibility for ambulation; hence, performing an amputation may become the first step to regaining functions. [2,3]

Although many epidemiologic studies about amputation have been reported from developed countries, reports from developing countries are few.[3,4] In Turkey, there have been a number of studies from different regions; [5,11] but in the province of Van, which is situated at the eastern part of the country, there are distinct causes of amputation due to geographical and cultural characteristics. As a result of its situation near the border zone, gunshot wounds are rather common. Additionally, mistreatment by traditional bone- setters; burns caused by falling into tandir ovens which are used for cooking bread; and Diabetic foot infections are come across frequently.

We conducted a retrospective study of extremity amputation at the Orthopedics and Traumatology clinics which are the only centers capable of performing amputation in Van. In our study, we assessed amputations and extemity salvage surgery, so as to specify the distinct causes of amputation in our region, which are related with geographical and cultural conditions.

Table 1. Age distribution of cases

Age	n	%
0-10	59	13.4
11-20	84	19.1
21-30	109	24.8
31-40	43	9.8
41-50	39	8.9
51-60	41	9.3
>61	65	14.8
Total	440	100.0

Patients and methods

475 amputations of 440 subjects (345 male, 95 female, mean age: 28.5, ranging 3 months-85 age) were retrospectively researched for age, sex, side, etiology and amputation site which were performed between August 1995 - August 2005; during a ten-year period.

Results

Age distribution was examined in 7 groups (Table 1). 21-30 year-old cases made up the largest age group (109/440). The ratio of cases younger than 10 years to all cases was 13.4 %.

218 amputations (45.9%) were performed for upper extremity, 257 amputations (54.1%) for lower extremity. 144 amputations (30.3%) were major (above wrist-ankle) and 331 (%69.7) were minor (below wrist-ankle).

223 subjects had extremity amputation on the right side, 188 subjects on the left side, and 29 subjects on more than one extremity (Table 2). The two polydactylia patients who had 4 extremity amputations had their extra fingers at both hands and feet amputated. One of the two patients who had undergone 3 extremity amputations, had fingers of both hands and left leg (below knee level) amputated because of purpura fulminans; the other patient had amputations at right below-elbow, left above-elbow and right below-knee because of electrical burn.

Among the 25 patients who had two extremities amputated, 11 subjects had amputations for the toes of both feet, 8 subjects for the fingers of both hands, 1 subject for the left forearm and right ankle, 1 subject for fifth finger of the left hand and all fingers of the right hand, 1 subject for above-knee and below-elbow, 1 subject for bilateral below-knee, 1 subject for right below-knee and partial left

Table 2. The number and side distribution of extremities

Side	Number	Extremities	%
Right	223	223	47.0
Left	188	188	39.6
2 extremity	25	50	10.5
3 extremity	2	6	1.3
4 extremity	2	8	1.7
Total	440	475	

Table 3. The distribution of the amputation level by reasons on upper and lower extremities

Upper extremity	Should er	Above elbow	Elbow	Below elbow	Wrist bileği	hand	Partial hand	Total
Gunshot	–	2	2	4	9	2	34	53
Occupational accidant	–	–	–	1	1	1	27	30
Cutting tool	–	–	–	–	–	–	32	32
Trafffic accidant	–	1	1	1	1	–	5	9
Diabetes mellitus	–	–	–	–	–	3	3	6
Congenital diseases	–	–	–	–	–	–	19	19
Peripheric vasc diseases	–	–	–	1	1	–	–	2
Buerger's disease	–	–	–	–	–	–	1	1
Tumor	–	1	–	–	–	1	1	3
Electirical burn	2	2	–	1	–	–	–	5
Bone setter	1	1	–	–	–	–	–	2
Leprosy	–	–	–	–	–	–	1	1
Purpuna fulminans	–	–	–	–	–	–	3	3
Frostbite	–	–	–	–	–	–	4	4
Others	–	–	–	–	–	–	48	48
Total	3	7	3	8	12	7	178	218
Lower extremity	Hip Knee	Abov	Knee knee	Below	Ankle foot	Partial	Toes	Total
Gunshot	–	3	2	14	3	12	6	40
Occupational accidant	–	2	–	2	–	–	1	5
Trafffic accidant	–	5	3	7	–	2	3	20
Diabetes mellitus	–	10	–	20	–	14	36	80
Congenital diseases	–	–	–	–	–	–	26	26
Peripheric vasc diseases	–	10	2	10	–	–	6	28
Buerger's disease	–	2	–	2	–	2	4	10
Tumor	3	3	–	1	–	–	–	7
Electirical burn	–	–	–	2	–	1	1	4
Tandir oven	–	–	–	–	–	1	6	7
Enfection(Osteomiyelitis)	1	–	–	–	–	–	4	5
Bone setter	–	1	–	–	–	–	–	1
Leprosy	–	–	–	1	–	–	1	2
Deformity	–	–	–	–	–	–	2	2
Purpuna fulminans	–	–	–	1	–	–	–	1
DIC	–	–	–	–	–	–	1	1
Arterial injury	1	–	–	–	–	–	–	1
Frostbite	–	–	–	–	–	–	1	1
Others	–	–	–	–	–	–	16	16
Total	5	36	7	60	3	32	114	257

foot, and 1 subject for the first finger of the left had and the first toe of the left foot. The distribution of amputation sites with regard to their causes is shown in Table 3.

Trauma was found to be the most common indication for amputation (177 of the 440 subjects (40.2 %). The indications related with trauma include gun woundings (n=45), mine (n=33) and hand grenade (n=7) explosion (85 of 177 subjects), which are the first reason of the traumatic amputations. Occupation-related accidents (34 subjects), cutting tool injuries (30 subjects), traffic accidents (28 subjects)

were followed. Other indications for amputation were, in order of frequency; Diabetes Mellitus (86 subjects), congenital diseases (33 subjects), peripheral vascular disease (30 subjects) were seen.

Hand finger amputations were the most common (178 extremity); followed by toes (114 extremity) (Table 3). Replantation was performed in 24 cases and was successful in 15 (62.5%) cases.

Discussion

Limb loss and limb deficiency are potentially disabling conditions affecting health and well-being of persons worldwide. There are multiple pathways to the loss of a limb, including Diabetes Mellitus, peripheral vascular disease, trauma and malignancy.[3] These etiologies of amputation may vary in different countries or regions.[4] In Van region, distinct etiologies of amputation are encountered due to socioeconomic, cultural and geographical characteristics. Van is located at the eastern part of Turkey, bordering with Iran. Surrounding provinces make up the border zone with Iran and Iraq. Gunshot wounds and mine explosions are frequent at the border zone. Consanguinity marriages and congenital diseases due to multiparity are also common. Hospitals in Van are reference centers for surrounding provinces for amputation as well as many other emergency conditions.

Trauma was the most common cause of amputation (177) in our study. Traumatic causes included, in order of frequency, gunshot and mine accidents, occupational injuries, cutting tool and traffic accidents. Being the most common causes, gunshot and mine explosions contrasts with other studies in our country, which have shown that traffic accidents and occupational injuries are the most common cause of amputation.[5] This is thought to be related with the fact that, as being a border city, mine explosions due to smuggling, and gunshot and hand grenade wounds due to terrorist attacks which are seen more frequently in Van. As a result of gun wounds, mine explosions and hand grenade explosions; 45, 33, and 7 amputations were done respectively.

Diabetes Mellitus, congenital diseases and peripheral vascular diseases were the other major causes of amputation except trauma. In our study, amputations related with uncontrolled Diabetes Mellitus were the second most common cause (86 cases). In developed countries, many studies have shown diabetic amputations to be the most common etiology of amputation.[12,13] More than 50% of lower extremity amputations are performed for subjects with diabetes.[14,15] Gurlek et al. applied 54 amputation (36.7%) of 147 diabetic foots. This ratio was 19.6% in our study.

Amputations due to congenital anomalies were the third common cause of amputation. It was found that congenital limb deficiencies outnumber acquired losses by a ratio of 2:1, but among unilateral cases, more lower-limb amputations were acquired postpartum than congenitally.[16] Kostakooglu et al.[17] applied to proximal phalanges or soft tissue excision for eight cases (5 for foot, 3 for finger) because of macrodactyl. However, due to skin necrosis they had to perform amputation from proximal interphalangeal joint in one cases. Most of our cases with congenital diseases had hand and foot polydactily and these cases have mostly undergone bilateral amputation.

It was found there is an increased risk of dysvascular amputations over the years, particularly among elderly and minority populations.[18] In concordance, in our study, peripheral vascular diseases were seen in the elderly population, and mostly led to lower extremity below knee or above knee amputations (20 of 30 cases with amputations due to peripheral vascular disease), which made up the fourth common cause of amputation in this study.

Burn-related amputations (amputations due to electrical burns and tandir-oven accidents) seen in our region are a result of uneducated and ignorant electric use and falls into tandir ovens used frequently in our region for cooking bread. Faciotomy was performed in electrical burns before amputation. Cooking bread in tandir ovens is peculiar to our region. Particularly children fall into these ovens because the top of the oven is open. After these injuries, especially hand finger or toe amputations are required, either early or late due to finger deformities. Amputations due to tight casts applied by uneducated people or infections following interventions by traditional bone setters are seen relatively more common than other regions of Turkey. In this study, 12 of 19 amputations which were related with burns and bonesetter sequelae were performed for 0-10 year old children. The ratio of bonesetter sequelae as an amputation etiology in all cases was 3 in 440 cases. In a study from Nigeria, this ratio is reported as 9 in 87 cases.[19]

Nagashima et al.[20] have reported a dysvascular amputation ratio of 5.3% of which was due to Buerger's Disease. Ateş et al. [21] have performed amputation on 155 patients out of 344 (%53), who were being cured surgically due to Buerger's disease. In our study, amputations due to Buerger's Disease comprised 11 of 440 cases.

Primary malignant cancer of the bone, although rare, is the third most common cancer in patients between the ages of 10 and 24 years, as reported by Young et al.[22] Malignancy was the cause of amputation in 10 of 440 cases in this study. Amputations due to osteomyelitis were performed mostly for toes.

Frostbite was seen in refugees attempting to cross the border illegally in winter, and in villagers who had lost their way. Among patients who presented at a late period with necrosis at fingertips, 1 patient had an amputation for right hand fingers, 1 patient at distal phalanges of the left hand and foot, and 1 patient had an amputation of both hands.

Leprosy, however being rare, may still be seen in our region, and 1 patient with leprosy had a toe amputation and 1 patient with leprosy had a left hand finger amputation in our clinic. 1 patient had an above knee amputation at the state hospital due to leprosy. Amputations related with deformities were performed for 2 toe deformities causing walking problems. Hand finger, below knee and toe amputations were performed for 1 DIC and 2 purpura patients being followed by pediatrics.

Although arterial injuries during elective orthopedic procedures are uncommon, the complications are significant and the morbidity in terms of limb loss and long-term functional deficit can be devastating.[23] A patient, who had had a vascular injury and repair during total hip endoprosthesis operation in another center, had hip amputation later because of infection that developed after vascular repair.

Unspecified traumatic causes or rarely encountered causes (such as being injured by a falling stone or getting an extremity caught in chains) were classified as other causes. These were mostly related with hand fingers and toes. Decision of amputation in injuries with vascular damage requiring emergency intervention is difficult for both the surgeon and the patient, because criteria for primary amputation rely on subjective rather than objective data.In 1985, Gregory et al.[24] suggested an index to be used to estimate beforehand whether an extremity which has been cut off will proceed to amputation or not. Helfet et al.[25] transformed this index to a simpler scoring system in 1990, called 'mangled extremity severity score' or MESS. They proposed a mangled extremity severity score (MESS) based on four variables i.e. skeletal/soft tissue injury (1-4 points), limb ischemia (0-3 points), shock (0-2 points) and patient age (0-2 points). The score takes into consideration patient's age, hemodynamic status, ischemia level of the extremity and severity of trauma; extremity saving procedures are recommended for 6 points or less and amputation for 7 points or more. Sharma et al.[26] reported in a prospective study that MESS ≥7 is specific and 100% accurate for estimating amputation in advance. In our study, 9 unsuccessful results in 24 replantation cases were those with gunshot wounds and crush injury which had undergone replantation although the MESS score was above 7. Bora et al.[27] executed replantation on 136 extremities which belong to 83 patients and they obtained successful outcomes on 112 extremities (82%). For 8 out of 440 patients underwent reamputation at an upper level (especially DM and gunshot wounds). 42 cases also had different operations besides amputation. 12 faciotomies, 11 V-Y grafts, 5 skin grafts, 4 skin flaps and 1 free fibula graft was performed. Among patients with gunshot and mine explosion wounds, 6 cases had an additional operation for foreign objects in the eye and 3 cases for gastrointestinal problems. Sobacı et al.[28] evaluated 285 eyes for 260 people who had an eye injury related to teror and they indicated that 17 of these eyes (% 6.54) have traumatic amputation on their extremities

As a conclusion, amputations due to mine explosions, gunshot wounds, bonesetter malpractice and burns after falling into a traditional tandir oven are seen frequently in our region. After these accidents, patients have only a limited chance for surgical treatment. On the other hand, trauma, burns, DM and peripheral vascular diseases are preventable causes of amputation. Prevention of smuggling and terrorist activities, cancellation of fire-gun licences, foundation of specialized centers for replantation surgery, education of patients with DM and peripheral vascular diseases, dietary modifications and foundation of special DM centers will lead to a significant decrease in the frequency of amputation operations.

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