ORIGINAL ARTICLE

Audit of lower extremity reconstruction and functional outcome analysis

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Abstract:
Objective: We aim to look at the epidemiology of lower limb trauma and study the post-operative functional outcome.
Study Design: Descriptive study
Setting: Burns and Plastic Surgery Center, Hayatabad Medical Complex, Peshawar
Duration: six years
Material and Methods: After approval from the ethical board, data was collected from hospital records. Data regarding patient demographics, site, anatomic location of injury, and type of reconstructive procedure done was collected. Complications including partial (significant or insignificant) or complete necrosis was documented. Toronto extremity Salvage (TESS) score was calculated.
Results: A total of 73 patients underwent lower limb reconstruction with mean age of 28.7+12.5 SD. Road traffic accidents (RTA) were the main cause of lower limb trauma (45.2%). There were 54.8% defects with associated fractures, most commonly tibia. The mean duration of presentation for reconstruction was 5.3 week +10.23SD. Total of 81 flaps were performed (68 pedicled and 13 free micro-vascular flaps). 35-patients required bony stabilization. Infection (8.2%) was the most common complication. Partial Flap necrosis was observed in 4(5.5%) cases, out of which 3(4.1%) were significant partial necrosis. Mean Toronto Extremity Salvage Score (TESS) was 84.8+13.6 SD.
Discussion: Mostly younger male population are involved with lower limb trauma. Most patients had delayed presentation due to under developed infra-structure in the tribal areas and issues with timely referral from peripheral health care facilities. Most of the small and medium defects can be closed with local flaps. However large defects with bone involvement required free microvascular flaps. Post-operative outcome was good using TESS score.
Conclusion: Robust referral system and single stage orthoplastic procedures should be adopted. Multi-center studies need to be conducted and liaison with orthopedic department is paramount to improve outcomes.

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Introduction:

Due to the rapid urbanization in developing countries, the incidence of road traffic accidents is on the rise. This translates into a higher rate of lower limb injuries as well.[1-4] These injuries can be a substantial impact on the quality of life of patients. Most of the patients will have to take a break from their profession or change it altogether.

Epidemiology: Getting a lower limb injury can be a devastating and life changing event for the patient and their families. It can have both financial and psychological implications. The annual cost of care for such patients runs in thousands

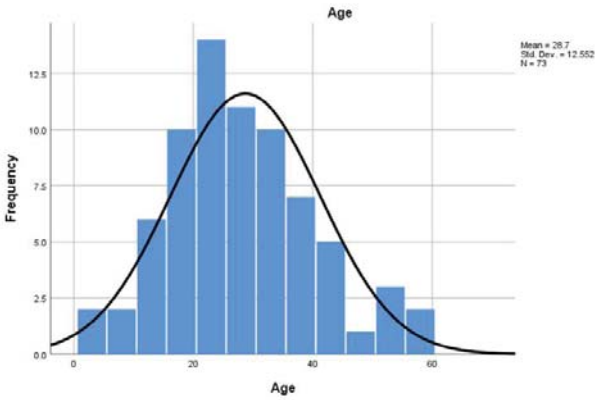

Figure 1: Age distribution

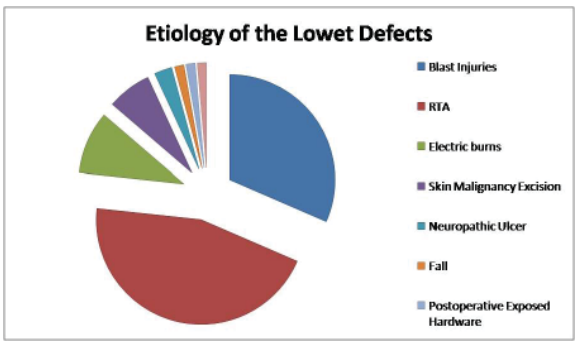

Figure 2: Etiologies of lower limb trauma

of dollars.[5] As males are more prone to get lower limb trauma, the financial problems can be significant.[6] If complications occur, the treatment costs compounds for the patient. If timely care is not provided the risk of amputation can increase overtime as well.[7] Prolonged treatment and long hospital stay can have significant effect on these patients, especially in the first there months after sustaining injury.[8-10]

In traditional approach, the lower limb trauma is primarily managed on Orthopedic floors. Now contemporary practices focus on integrated approach towards these injuries. Timely reconstruction can help lower amputation rates in these patients along with improving quality of life.[7,11]

The spectrum of lower limb trauma is large and the management mostly depends on local practices and experiences. Little data is available locally on lower limb trauma. There is lack of comprehensive data regarding reconstruction of lower limb on the national level. By conducting this study we will be able to focus our resources and train our human resource in management of the most common injuries. This will help to streamline patient load and will be cost effective for the healthcare facility by adopting integrated approach towards lower limb trauma. We aim to look at the epidemiology of lower limb trauma and study the post-operative results.

Materials and Methods:

This is a descriptive study conducted at Burns and Plastic Surgery division at Hayatabad Medical Complex, Peshawar. Data of patients presenting with lower limb defects secondary to trauma or tumor was collected from 2015 to 2022. All patients presenting with trauma were included in this study. Records were obtained from the patient files and operating notes after taking approval from the ethical board. Follow-up was done in the outpatient setting. Demographics of the patient population was collected at the time of presentation. Injuries were classified based on the mechanism of injury, size of the defect, anatomical location of the defect and presence of fractures. Patients with fractures were further classified based on the type of fixation (internal or external) used by the Orthopedic Surgeon. Time since injury and time to reconstruct the defect along with the type of reconstruction done and number of procedures to done for each patient was recorded. Data was analyzed using IBM SPSS statistics 23. Frequencies and means were calculated for demographic data. Injury type was stratified against the reconstruction and complications reported. Defects were classified as small (<5cm), medium (5-10cm) and large (>10cm). Post-operatively the patient was evaluated for flap necrosis. Flap necrosis was evaluated as partial insignificant (which does not need any surgical intervention), partial significant (requiring surgical intervention) and complete. Patients were assessed for complications at follow-up visit and TESS score was calculated for each patient.[12]

Results:

A total of 73 patients underwent lower limb

Table 1: Anatomical distribution of the lower limb defects

S/No.	Site of Injury	Frequency (n)	Percentage
1	Upper Third of Leg	7	9.6 %
2	Posterior Ankle	5	6.8 %
3	Upper Two Third of Leg	6	8.2 %
4	Lower Two Third of Leg	7	9.6 %
5	Heel	7	9.6 %
6	Lisfranc Amputation Stump	1	1.4 %
7	Middle, upper, lower thirds of leg	3	4.1 %
8	Circumferential Foot Defect	1	1.4 %
9	Heel, Sole	1	1.4 %
10	Middle Third of Leg	8	11.0 %
11	Middle Two Third Leg	1	1.4 %
12	Lower Third of Leg	10	13.7 %
13	Lateral side Ankle	2	2.7 %
14	Dorsum of Foot	2	2.7 %
15	Sole	2	2.7 %
16	Knee	6	8.2 %
17	Upper Thigh/Groin	4	5.5 %
	Total	73	100.0

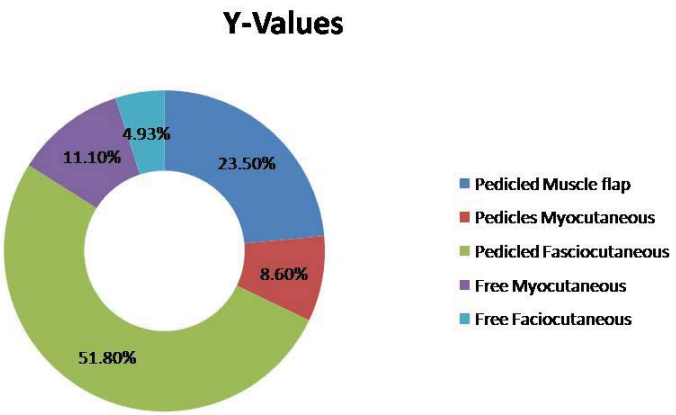

Figure 3: Flaps used to reconstruct the defects

Table 3: Frequency of complications

Complications	Frequency (n)	Percent (%)
No Complications	60	82.2
Necrosis	2	2.7
Infection	6	8.2
Deheiscence	2	2.7
Infection, Deheiscence, Necrosis	3	4.1
Total	73	100.0

reconstruction during the study period. The study population included 59(80.8%) male and 14(19.2%) females with age ranging from 3 to 57 years with mean of 28.7+12.5 SD as show in figure-1. Right lower limb was affected in 65.8% of the patients. Road traffic accidents (RTA) were the main cause of lower limb trauma (45.2%) followed by blast injuries as shown in Figure 2. Lower third and middle third of the leg were the most common anatomical areas presenting with defects for reconstruction, affecting 13.7% and 11% of the study population respectively as shown in table 1. The most common defect size was medium (56.2%), followed by large (38.4%) and small (5.5%) defects. Out of the total, 54.8% defects were associated with fractures of the underlying bones. Tibia was the most commonly fractured bone (37%). The mean duration of presentation of the patient for reconstruction was 5.3 week +10.23SD. The mean time of reconstruction after injury was 6.5+10.1 SD. Total of 81 flaps were performed in the study population, including 68 pedicled and 13 free micro-vascular flaps. Reverse sural faciocutaneous was the most common pedicled falp while free Latissimus dorsimyocutaneous was the most frequent performed free flap, accounting for 28.4% and 11.10% respectively (Figure3, Table: 2). In most of the cases (61.6%) reconstruction was completed in a single stage. A total of 35 patients (47.9%) required bony stabilization, in which 74.1% cases, external fixator was applied. Infection was the most common complication, observed in 8.2% cases (Table 3). Partial Flap necrosis was observed in 4(5.5%) cases, out of which 3(4.1) were significant partial necrosis and required a secondary reconstructive procedure. The Toronto Extremity Salvage Score (TESS) ranged from 5% to 99.3% with a mean of 84.8+13.6 SD.

Discussion:

In our study, most of the participants were young males in the third decade of their life. Most of the participants were male. Other studies done in the developing world also show a similar trend.[3,13] Rustogi et al. had a predominantly younger population of patients in the

Table 2: Types of flap performed

S/No	Flap Type	Frequency (n)	Percent (%)
1	Reverse Sural Flap	22	30.1
2	Pedicled ALTF	2	2.7
3	Free ALTF	3	4.1
4	Free LD (Myocutaneous)	9	12.3
5	Medical Gastrocnemius, Soleus, Proximally based Sural Flap	1	1.4
6	Medial Gastrocnemius, Medial Soleus	5	6.8
7	VRAM	1	1.4
8	MSAP	1	1.4
9	Posterior Tibial Artery Perforator Flap	4	5.5
10	Free ALTF, Reverse Sural Flap	1	1.4
11	Proximally Based Sural Flap	4	5.5
12	Rotation Flap	1	1.4
13	TFL	1	1.4
14	Lateral Hemisoleus Muscle Flap	1	1.4
15	Medial Gastrocnemius Muscle Flap	1	1.4
16	Medial Gastrocnemius Myocutaneous Flap	5	6.8
17	Medial Hemisoleus Muscle Flap	3	4.1
18	Distally Based Peroneus Brevis Muscle Flap	2	2.7
19	Medial Planter Flap	3	4.1
20	Saphenous Artery Flap (Antigrade)	1	1.4
21	Saphenous Artery Flap (Retrograde)	2	2.7
	Total	73	100.0

age bracket of 15 to 30 years old. Males were six times more common as compared to females.[3] In our study, the female population was about a quarter of total patients.

Most common cause of lower limb trauma was road traffic accidents in our study, followed by bomb blast injuries. Most of the studies report road traffic accidents to be the common cause of lower limb trauma followed by industrial accidents.[14,15] Bomb blast injuries were the second common cause due to prevailing security situation during the past few years in the region. Divsalar P. et al. studied road traffic accidents under the influence of addictive substances. They reported methadone to be the most common substance of abuse while most common injuries were lower limb trauma.[16]

Patient presentation at our center was mostly delayed as mean time for reconstruction after the trauma was several weeks in our study. This is mostly because most of our patients are initially treated in periphery in low resource setting. We think that a robust referral system needs to be in place connecting peripheral facilities with the main Level I and Level II centers. Although we

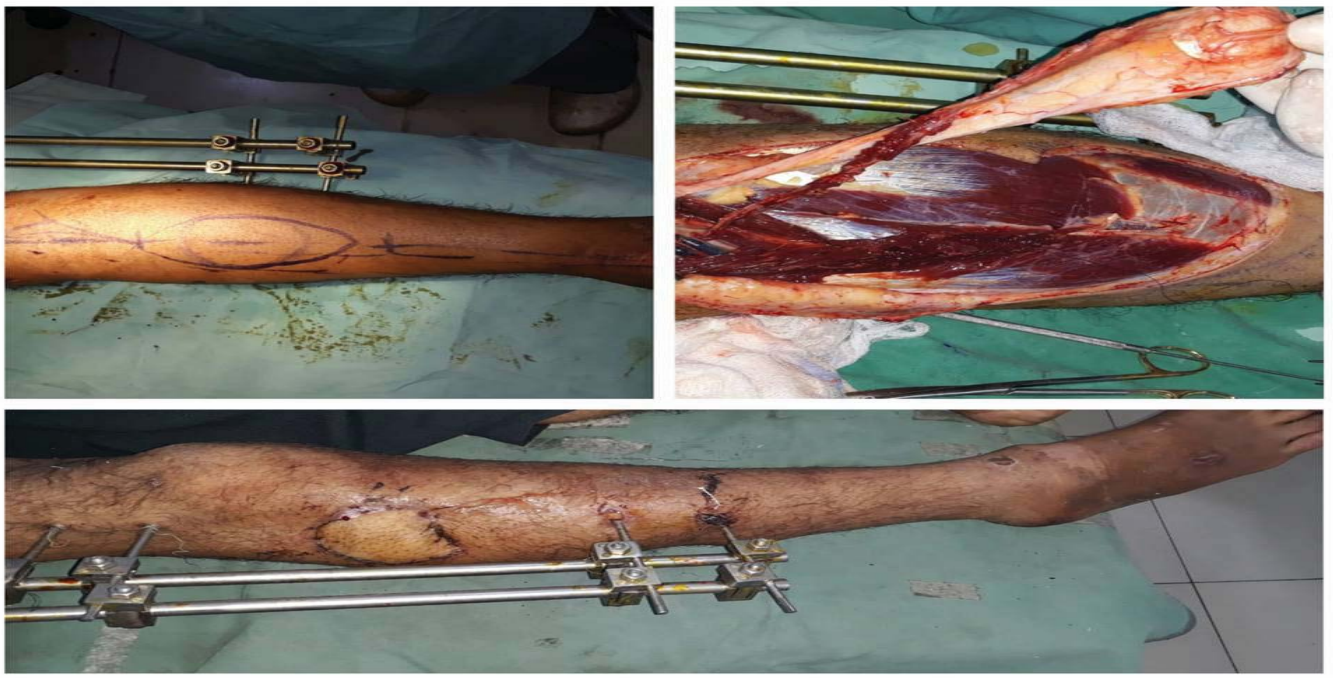

Figure 4: Patient with a defect on the upper 1/3rd of right leg. A. Medial Sural artery perforator (MSAP) flap designed. B. MSAP dissection with pedicle visible. C. Flap after 1 month of surgery.

Figure 5: A young 29 year old female presented with residual Sarcoma arounf the right ankle. B. Complete resection of the tumor. C. Free Anterolateral thigh flap done for defect coverage.

are working towards a good Orthoplastic team in our setup, a major proportion of our patients are presenting from periphery with delayed presentation and this proportion is increasing with time due to growth of many medical facilities in rural areas of our province. Under-developed infrastructure and lack of health facilities in the tribal belt also contributes to delay in timely treatment of these patients. A combined orthopedic and plastic surgery approach by simultaneous fixation and prompt soft tissue coverage can significantly improve patient outcomes and hospital stay of the patients.[17-20]

We used pedicled faciocutanoeus flap in about half of our patients. Most common pedicled flap done was reverse sural flap for ankle and leg defects. In literature, there is a large plethora of fasciocutanoeus and myocutaneous flaps reported in both free and pedicled fashion depending on the region.[21-25] For small and medium sized defects, local pedicled flaps were used. However, larger defects required a free microvascular tissue transfer. Mean TESS score for functional outcome was good.

As data for this study was collected in a retrospective fashion, there were several patient charts with missing data. Those patients were eventually excluded from the study which can impact on the outcomes. Data extraction was also a problem and several variables that the authors considered important could not be included in the study.

There is lack of statistics on epidemiology of lower limb trauma. Moreover, the referral system needs to be improved a lot in order to im-

Figure 6: A 5 year old child with leg defect involving upper and middle 1/3rd of the leg. B.Hemi soleus and hemi gastrocnemious muscle flap raised to cover the defect. C. After flap inset. D. Flap inset done followed by split thickness skin graft for the defect.

prove outcomes. The referral systems should be such that a patient can reach level I and Level II trauma centers. Moreover, large multi-center studies need to be conducted to make standardized referral and management protocols for such patients.

Conclusion:
Robust referral system and single stage orthoplastic procedures should be adopted. Multicenter studies need to be conducted and liaison with orthopedic department is paramount to improve outcomes.

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Role and contribution of authors:
Mansoor Khan, collected the data, references and did the initial writeup

Waqas Hayat, collected the data and helped in introduction writing.

Hidayat Ullah, collected the references and helped in discussion writing.

Nasir Hayat Khan, collected the data and helped in interpretation of data.

Qazi Amjad Ali, collected the data, references and helped in result writing.

Anastasia Koronaiou, critically review the article and made final changes.

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