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Research Article

The MESS: is it must?

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ABSTRACT

Background: Massive lower extremity trauma presents an immediate and complex decision making challenge. Significant advancements have made in the field of reconstructive surgery over the past 30 years. Severely traumatised limbs which would have been treated by primary amputation 20 years ago are beginning to be saved. On the contrary, such extensive reconstructive procedures may not always produce the best of results in terms of functional outcomes. Thus the management of a severely crushed extremity presents a therapeutic dilemma as whether to amputate or to attempt salvage.
Methods: All Prospective study of 40 patients with severe crush injury to the lower extremities treated in Sri Ramachandra Medical College, Chennai between June 2012 and June 2014. The inclusion criteria were grade IIIb and grade IIIc open fractures of the lower extremity with a Mangled extremity severity score (MESS) of 7 and above with minimum of 12 months follow up. All the fractures were classified according to the Gustilo and Anderson classification system and Mangled extremity severity score. Out of the 40 patients 18 of them had their limbs salvaged and 22 underwent primary amputation.
Results: The lowest MESS in this study was 7 and highest MESS was 12. The mean score in the limb salvage group was 8 and in the amputated group was 9.7. Complication rates in salvage group were higher. The mean SF score for amputated group for physical component summary was 40.15 and mental component summary was 44.30 while for limb salvage group score for physical component summary was 30.91 and mental component summary was 36.90.
Conclusions: The MESS scheme provides excellent guidelines to the treating surgeon when faced with a dilemma of whether to attempt salvage or amputate a severely injured limb. The decision of whether to amputate or salvage an injured limb must be made very early in the course of treatment. This is because immediate amputation is most often viewed by the patient as a result of injury; whereas, delayed amputation is often considered as a failure of treatment.

Keywords: Amputation, Limb salvage, Crush injury

INTRODUCTION

Massive lower extremity trauma presents an immediate and complex decision making challenge. Significant advancements have made in the field of reconstructive surgery over the past 30 years. Severely traumatised limbs which would have been treated by primary amputation 20 years ago are beginning to be saved. On the contrary, such extensive reconstructive procedures may not always produce the best of results in terms of functional outcomes. Thus the management of a severely crushed extremity presents a therapeutic dilemma as whether to amputate or to attempt salvage. The challenge to the modern traumatologist is not the availability of reconstructive techniques. Now-a-days reconstruction efforts may provide an appropriate alternative to amputation in producing a functional result for a patient that surpasses that of primary amputation. Microsurgical reconstructive procedures have made it possible to attempt limb salvage even in the most extreme cases. It is imperative to remember that prolonged salvage attempts may destroy a person physically, psychologically,

socially and functionally. Failed limb salvages may lead to devastating complications and prolonged rehabilitation. Hence, the decision of whether to salvage or amputate an injured limb must be made very early in the course of treatment.

METHODS

Prospective study of 40 patients with severe crush injury to the lower extremities treated in Sri Ramachandra Medical College, Chennai. The study period was between June 2012 and June 2014. The inclusion criteria were grade IIIb and grade IIIc open fractures of the lower extremity with a Mangled extremity severity score of 7 and above with minimum of 12 months follow up. The exclusion criteria were patients who succumbed to their injuries within 48 hours and patients with crush injuries of foot. All the fractures were classified according to the Gustilo and Anderson classification system[1,2] (Table 1) and Mangled extremity severity score[3-5] (Table 2). Out of the 40 patients 18 of them had their limbs salvaged and 22 underwent primary amputation. All the patients were treated by same team of doctors from orthopaedics and plastic surgery. The physiotherapy was given by a single unit physiotherapist following standard regimen.

Table 1: Mangled extremity severity score.

Mangled extremity severity score		
1.	**Bone and soft tissue injuries**	
	Low energy (stab, simple, low velocity gun-shot)	1
	Medium energy (open/multiple fractures or dislocation)	2
	High energy (close range/high velocity gun shot, crush)	3
	Very high energy (above plus contamination)	4
2.	**Time of ischemia**	
	Peripheral pulses palpable	0
	Peripheral pulses not palpable but capillary pulse normal	1*
	No pulse in Doppler, refill >3 sec, paresis incomplete	2*
	No pulse, cold extremity, paresis complete	3*
3.	**Circulation**	
	Systolic blood pressure always >90 mmHg	0
	Hypotensive transiently	1
	Persistent hypotension	2
4.	**Age**	
	<30 years	0
	30-50 years	1
	>50 years	2
*Double points if time of ischemia >6 hours score of >7-amputation		

In our study we have 40 patients, out of which 36 (94%) were males and 4 (06%) were females.

Table 2: Gustilo and Anderson classification.

Gustilo and Anderson classification	
Grade I	Clean skin opening of <1 cm, usually from inside to outside; minimal muscle contusion; simple transverse or short oblique fractures
Grade II	Laceration >1 cm long, with extensive soft tissue damage; minimal to moderate crushing component; simple transverse or short oblique fractures with minimal comminution.
Grade III	Extensive soft tissue damage, including muscles, skin and neurovascular structures: often a high energy injury with severe crushing component.
Grade IIIA	Extensive soft tissue laceration, adequate bone coverage; segmental fractures, gunshot injuries, minimal periosteal stripping.
Grade IIIB	Extensive soft tissue injury with periosteal stripping and bone exposure requiring soft tissue flap closure ;usually associated with massive contamination
Grade IIIC	Vascular injury requiring repair.

The age group ranges from 18 to 60 years (mean 32 years). 24 patients had road traffic accident, 12 had crush injury while 2 had a train accident and 2 had a motor boat injury. 22 patients had grade III B fractures while 18 (45%) patients had grade III C fractures. The lowest MESS in the study was 7 and highest MESS was 12. The mean MESS score in the limb salvage group was 8 and in the amputated group was 9.7. All the patients were evaluated using SF12 quality of life questionnaire at the end of 1 year follow up and further follow ups.

RESULTS

All patients in amputated group had primary guillotine amputation done. The level of amputation was above knee in 10, below knee in 8 and knee disarticulation in 4 patients. Revision of amputation level was done in 6 patients. Out of which 2 had revision below knee amputation, 2 had knee disarticulation to above knee amputation and remaining 2 had above knee amputation to hip disarticulation. Stump closure was achieved by secondary suturing in 18, Latissimus dorsi free flap in 2 patients and split skin graft in 2 patients. Patients underwent minimum of 2 surgeries and maximum upto 3 surgeries. Functionally 2 patients had pain on walking, and 18 were able to walk independently without any walking aid. 18 were able to climb stairs while 18 patients went back to work. The mean SF score for Physical component summary was 40.15 and mental component summary was 44.30. The comparison of amputated and limb salvage group were as per Table 3.

Table 3: Comparison between amputated and limb salvage group.

Subject	Amputated group	Limb salvage group
Infection	Nil	88%
Deformity	Minimal	Significant
Hospital stay	3 weeks	24 weeks
Surgical procedures	2.5	7.5
Pain and swelling	Nil	100%
Weight bearing	Full	Partial
Return to work	82%	11%

All patients in limb salvage group had primary wound debridement and external stabilization done. Subsequent procedures for soft tissues cover like Latissimus dorsi free flap was done for 10 patients; split skin graft was done for 6 patients while cross legged flap was done for 2 patients. Procedures for fractures like conversion to illizarov was done in 12 patients while Secondary bone grafting was done in 10 patients. The minimum duration of hospital stay was 16 weeks while maximum was 36 weeks. The mean duration was 24 weeks. The minimum number of surgeries that a patient underwent was 5 while maximum was 10 and the mean was 7. Functionally all patients had pain and swelling of their injured limbs. All of them were only on partial weight bearing and needed some form of hand held walking aid for ambulation. The mean SF score for Physical component summary was 30.91 and mental component summary was 36.90. The complications were tabulated in Table 4, 5.

Table 4: Complications in limb salvage group.

Subject	Number	Percentage
Infected nonunion	16	89%
Osteomyelitis	2	11%
Knee/ankle stiffness	18	100%
Equinus deformity	10	56%
Sensation of sole of foot		
Diminished	12	67%
Increased	6	33%

Table 5: Complications in amputated group.

Subject	Number	Percentage
Wound dehiscence	2	9%
Stump neuroma	2	9%
Phantom limb Sensation	2	9%
Fixed flexion deformity hip	2	9%
Fixed flexion deformity knee	2	9%
Infection	2	9%

Table 6: Statistical report.

Group	N	Mean ± SD	SEM	Group
PCS	Amputation group	22 ± 40.150	8.0983	1.7266
	Limb salvage group	18 ± 30.917	7.9751	1.8798
MCS	Amputation group	22 ± 44.300	8.5782	1.8289
	Limb salvage group	18 ± 36.900	5.6876	1.3406

Table 7: Independent samples test.

		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
PCS	Equal variances assumed	0.010	0.921	3.61	38	0.001	9.2333	2.5564	4.0582	14.4084
MCS	Equal variances assumed	0.565	0.457	3.13	38	0.003	7.4000	2.3600	2.6225	12.1775

DISCUSSION

The goal of limb salvage in a severely injured lower extremity was to create a limb that is functional. Often, this fundamental goal was obscured by the armamentarium of orthopaedic, vascular and plastic surgical techniques available for reconstructive endeavours. The most common mode of injury in our patients was road traffic accidents accounting for fifty seven percentage. The mean MESS in the group of patients who had their limbs salvaged was 8 and in those

who had amputation was 9.7. This was because 16 out of 22 patients who underwent primary amputation had a warm ischemia time of more than 6 hours and also had severe contamination of their wounds which resulted in correspondingly high scores. 2 patients who had grade IIIC open fracture of both bones of the leg had their limb salvaged inspite of having an ischemic time of more than six hours. Those patients were only eighteen years old and their limb probably survived purely because of the collateral circulation. However, the final outcome of treatment in these patients was as bad as the other patients in the limb salvage group.

The duration of hospital stay[7] in patients who had limb salvage ranged from a minimum of 16 weeks to a maximum of 30 weeks with a mean of 24 weeks. This was considerably higher when compared to the duration of hospital stay of patients who underwent primary amputation. 12 out of 18 patients in the limb salvage group had diminished sensations of the sole of their feet. This would result in a loss of protective mechanism making these patients prone for ulceration which might eventually need amputation. 6 of the remaining patients had severe hyperesthesia of their legs and feet which was responsible for severe pain.

Limitations of functions of the injured limbs and their influence on activities of daily living were compared between both the groups. In the limb salvage group, all patients had pain and swelling of their legs, needed some form of hand-held walking aid for ambulation and had difficulty in climbing stairs. Only one patient in this group had gone back to her pre injury occupation, that too, only with modification. 20 patients in the amputated groups had prosthetic fitting within three to seven months from the time of injury. Analysis of these results has shown that patients in the limb salvage group have had significantly less - than - satisfactory functional outcome compared to patients who have had primary amputation. The above results in our study were comparable to the studies of Georgiadis et al.[8] and Boudrant et al.[9]

In Georgiadis's[8] study the outcome and quality of life patients who had an open fracture of the tibia associated with severe soft tissue loss was analysed. They compared 16 patients who had limb salvage using micro vascular free flaps and 18 patients who had below knee amputation. The patients who had limb salvage procedure had significantly more complications, more operative procedures and longer stay in hospital than patients who had an early below knee amputation. As far as functional results were concerned patients who had successful limb salvage took significantly more time to achieve full weight hearing, had significant knee, ankle and subtalar joint stiffness and were less willing or not able to work. Boundrant et al.[9] compared various parameters between patients who underwent primary amputation for open tibial fractures and those who had secondary amputation. They included forty three cases of which fourteen patients had undergone primary amputation and twenty three had secondary amputation. Delay in choosing option of amputation was associated with significant increase in number of surgical procedures, duration of hospital stay, rate of sepsis and non-union and overall disability.

The mean (SD) in SF 12 quality of life questionnaire PCS (physical component summary) score for Amputation group and limb salvage group were 40.2 (8.1) and 30.9 (8) respectively. The mean difference was 9.2 scores, which means that PCS for Amputation group was 9.2 scores more than the Limb salvage group which was statistically significant with P = 0.001. The mean (SD) MCS score for Amputation group and Limb Salvage group were 44.3 (8.6) and 36.9 (5.7) respectively. The mean difference was 7.4 scores, which means that MCS for amputation group was 7.4 scores more than the limb salvage group which was statistically significant with P = 0.003. From the Table 6, 7, we could interpret that in amputation group the mean PCS and MCS scores were higher in comparison to the limb salvage group and the difference was statistically significant. The quality of life of patients who underwent amputations were statistically significant when compared to patients who had their limb salvaged.

The MESS scheme provides excellent guidelines to the treating surgeon when faced with a dilemma of whether to attempt salvage or amputate a severely injured limb. The decision of whether to amputate or salvage an injured limb must be made very early in the course of treatment. This is because immediate amputation is most often viewed by the patient as a result of injury; whereas, delayed amputation is often considered as a failure of treatment. The patients who had primary Amputation have had better functional outcome in terms of being able to do their activities of daily living and getting back to pre-injury occupation, compared to patients who had Limb salvage. The surgeon should put into extensive use, his clinical experience, along with due consideration given to factors like available technical expertise, presence of other life-threatening injuries, socioeconomic status, and pre-injury occupation of the patient. It is imperative that the surgeon have a detailed discussion with the patient and the family whenever possible before making these decisions.

CONCLUSION

From the above observations, it becomes obvious that the attitude of "Save all extremities at all costs" indeed causes increased morbidity and that true surgical heroism may lie in being able to properly select the indication of primary amputation in a severely injured extremity.[10] The patients who had primary amputation had better functional outcome in terms of being able to do their activities of daily living and getting back to pre-injury occupation, compared to patients who had their limb salvage. Even though decades passed since MESS scoring was developed its usefulness can't be

underestimated in the present scenario and MESS is must.

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