

## Primary Below Knee Amputation in the Management of Compound Comminuted Fracture Lower Tibia and Fibula Due to High Velocity Missile Injury Associated with Bone Loss and Tibial Nerve Injury

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### ABSTRACT:

#### BACKGROUND:

Compound comminuted fractures of lower tibia and fibula are very common in Iraq these days due to missile injuries (bullets and blasts), it could be associated with bone loss and neurovascular injury this will interfere with the patients rehabilitation and leads to major social and economic burden on the patient, his family and the community.

#### OBJECTIVE:

To prove that primary below knee amputation in management of compound comminuted fracture lower tibia and fibula due to high velocity missile injury and complete tibial nerve injury is superior to limb salvage.

#### PATIENT AND METHODS:

This is a prospective comparative study including 25 patients age 30-60 years presented to the emergency department in Medical City with a history of missile injury during the period 2005-2007 they had compound comminuted fractures of lower tibia and fibula (Gustilo grade II, III) all of them had different degrees of bone loss (more than 5 cm) and all of them had complete tibial nerve injury and 10 of them had associated posterior tibial artery injury which is irreparable. We divided our patients in to two groups the first one (9 patients four of them had also associated vascular injury) we did primary below knee amputation, while the second group (16 patients six of them had vascular injury) who refused amputation we did wound exsion and application of external fixation. Both groups followed up clinically and radiologically for one year.

#### RESULTS:

Group I the patients rehabilitated early and a prosthesis were used after one and a half month and the patients return to their original work or changing their work and have almost normal life, group II all of them had prolonged course of treatment with economic and social problems.

#### CONCLUSION:

Primary below knee amputation is a very good option for patients with history of compound comminuted fractures of lower tibia and fibula (grade II and III) associated with bone loss and tibial nerve injury. Decreasing rehabilitation time and early return back to work also less cost and less social problems.

**KEY WORDS:** primary below knee amputation, compound fracture tibia and fibula, bone loss, tibial nerve injury.

### INTRODUCTION:

Historically trauma and infection have been responsible for most of amputations <sup>(1)</sup>, and injuries of the leg associated with fractures carry a high incidence of open and infected fractures because the tibia is just beneath the skin with frequency of

slow union due to poor blood supply of the distal fragment <sup>(2)</sup>Compound comminuted fractures of the lower tibia and fibula due to missile injury are very common in Iraq these days, most of our patients prefer a prolonged course of treatment to preserve their limbs but this prolonged treatment carry a lot of problems to the patient, to the orthopedic surgeon and to the community.

The patient's potential function and the quality of life need to be considered in the decision to amputate or salvage the mangled limb <sup>(3)</sup>

The leg consists of three compartments:

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- 1-anterior compartment contains Muscles(tibialis anterior,extensor hallucis longus, extensor digitorum longus and peroneus tertius), Vessels (anterior tibial artery and venacomitants), and Nerves (deep peroneal nerve).
- 2-Posterior compartment contains Muscles( superficial group:gasrocnemus, solus and plantaris, deep group: tibialis posterior, flexor digitorum longus and flexor hallucis longus in the lower two third), Vesseles (posterior tibial artery, peroneal artery and venacomitants), Nerves (tibial nerve).
- 3-Anterolateral compartment contains( peroneous longus and peroneus brevis muscles), no major vessel, receive their supply from several branches of peroneal artery), Nerves(superficial peroneal nerve)<sup>(1)</sup>

The more distal in the leg the less soft tissue cover and the more risk of infections and nonunion.

The tibial nerve composed of fibers from lumber roots 4,5 and sacral roots 1,2,3 is the largest branch of the sciatic nerve, injuries to the tibial nerve are very disabling because of the large sensory deficit on the planter surface of the foot with frequent association with causalgia; the effect of a complete tibial nerve lesion on the function of the foot is comparable in importance to that of combined median and ulnar nerve lesions on the function of the hand<sup>(4)</sup>, injuries of the tibial nerve due to missiles are mostly in the form of neurotmesis with massive loss of nerve tissue.

Guidelines for decision between amputation and salvage did not exist, however, nor had the social and economic consequences of limb salvage been addressed<sup>(3)</sup>

Bonanni et al 1993 gives the definition of mangled lower extremity as

- 1-Severe injury to three of four major organ systems in the same extremity.
- 2-Or severe injury to two of four organ systems in an extremity when the area of skin and muscle loss is greater than the circumference of the extremity and require free tissue transfer.
- 3-Or severe injury to two and minor injury to other two organ system in a extremity requiring surgical intervention.
- 4-Or severe injury in two of four organ system in an extremity with greater than 5cm of bone loss and priosteal stripping<sup>(4)</sup>

In decision of amputation it was agreed that if there is loss of three or more of the major components of the limb(skin , nerve ,blood vessel , muscle and bone) then amputation is indicated<sup>(5)</sup> To determine when amputation is not only justified but also beneficial, an objective tool to predict outcome is required<sup>(3)</sup>.

In 1976, Gustilo and Anderson based their prognostic classification scheme for open fractures on wound size they found the type III open fractures to have the worst prognosis, with a high rate of infection, nonunion, and secondary amputation<sup>(6)</sup>.

In 1984, Gustilo and associates subclassified the type III open fracture in to A,B,C<sup>(7)</sup>, Caudle and Stern found this classification to be prognostic<sup>(8)</sup>. all our patients had fractures grade II and III.

In this prospective comparative study we try to propose a new guideline that if there is bone loss more than 5 cm in compound fractures of lower leg plus injury of tibial nerve regardless the severity of soft tissue loss, then the amputation as a primary management is superior to limb salvage.

### PATIENTS AND METHOD:

Between 2005-2007, 25(table-1-) cases were admitted to orthopedic department in Medical City/Surgical Specialties Hospital with history (with in few hours ) of compound comminuted fractures of lower tibia and fibula with bone loss(more than 5 cm) and tibial nerve injury, after stabilization of their general condition we discuss with them the primary below knee amputation as good option for their early rehabilitation, nine of them all male agreed and 16 including 5 females refuse amputation and insist on preserving limb salvage.

We divide our patients in to two groups(prospective comparative study design) , group I nine patients we did primary below knee amputation and we kept the stump opened for second look after 72 hours then we did delayed primary closure of that wounds and we discharged the patient home after 48 hour of closure(total hospital stay five days), and group II 16 patients we did wound excion and application of external fixation then second look for the wound after 48 hours with consultation of plastic surgeon, 10 patients underwent second session of wound excion and all our patients need wound coverage by plastic surgeon(total hospital stay two weeks).

Table 1 :Number of the patients.

Patient's age/year	male	female
30-40	9	2
41-50	7	3
51-60	4	0
Total	20	5

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Our patients followed up clinically and radiologically for one year and we use the following scoring system:

### Scoring system:

- 1- Back to work: original work/30 change work/25 no/0
  - 2-Economic problems: none/20 few/10 frank/0
  - 3-Social problems: none/20 yes/0
  - 4- Pain: none/15 mild/10 moderate/5 severe/0
  - 5- No. of surgical procedures: two surgeries/10 three and more/ 5
  - 6-Infection: non/5 present/0
- Total points: 100 / high score indicates very good results

### RESULTS:

We followed our patients for one year; first visit was after two weeks of discharge home for inspection of their wounds and removal of stitches the second visit was after one month we sent patients of group I to the unit of prosthesis and

rehabilitation they have no pain and no evidence of infection. Group II patients still complaining of pain, nine of them had evidence of infection (discharge from their wounds and bad odor) which is treated by frequent wound exsion and appropriate antibiotics according to culture and sensitivity.

The next visit was after three months , Group I nine patients had scores of 90-100 , they had no social problems no infection seven of them got back to their original work and two change their work, eight had no pain, one describe mild pain, all of them had no economic problems(Table-2-).

Group II 16 patients had very bad results two of them got divorced all of them had frank economic problems, all of them describe pain of moderate to severe type no one of them got back to work after one year of follow up, nine of them got chronic infection and all of them had nonunion of their fractures all of them pass through long course of treatment of nonunion and infections with no benifit.there is no difference in the results whether the patient had associated vascular injury or not.

Table 2: Results

parameter	Group I /9 patients (36%)	Group II /16 patients (46%)
Pain	11,1% mild pain	100% moderate to severe
Economic problems	0%	100%
Social problems	0%	100%
Infection	0%	%56.25%
Back to work	100%	0%
No. of surgical procedures	two	Three and more

### DISCUSSION:

Amputation should be the first step in the rehabilitation of a patient with a nonfunctional limb rather than the final step of treatment, when we faced with a difficult decision regarding lower extremity amputation compared with attempted limb reconstruction expectations for a reasonable outcome must be determined<sup>(8)</sup>,

Amputation surgery should be considered constructive rather than destructive surgery<sup>(9)</sup>

Before treatment it is better to establish a reasonable expectation for functional independence after either limb salvage or amputation an evaluation should be done of the patient's functional level prior to injury, their ability to walk in the months prior to treatment, the expectation for amputation after either limb salvage or amputation<sup>(9)</sup>

The following four questions should be asked<sup>(9)</sup>:

- 1-Will limb salvage out perform an amputation and prosthetic fitting in terms of functional outcome for the patient?

- 2-What functional out come can be reasonably expected following either limb salvage or amputation?

- 3-What is the cost in both time and resource consumption?

- 4-What are the risks to the patient?

In Iraq these days we have a lot of accidents due to missile injuries(blasts and bullets) this makes a great burden on the orthopedic surgeons and the medical institutions in addition to that a high percentage of our patients are manual workers and have families to support, we face a lot of cases that had compound fractures of lower tibia and fibula with different degrees of soft and bone loss, we collect only this group of patients who had bone loss more than 5 cm and proved tibial nerve injury, some of them also had posterior tibial artery injury especially in very lower fractures where the artery is in close anatomical relation to the nerve. Most of our patients with this type of injury refuse

amputations and insist on limb salvage, after follow up of such patients we experience a lot of problems such as resistant chronic bone infections, nonunion of their fractures any many of them had failed multiple operations of fixation and bone graft, and their insensitive feet are liable for injury and neuropathic ulcers, in addition to severe economic problems and social problems most of them don't return back to work and they are jobless so divorce and social isolation are part of their lives. So we decide to compare the result of primary below knee amputation and limb salvage, our results show that not all patients agree about the idea of amputation although three of them come to hospitals asking for amputation when they get exhausted economically and socially. all the patients who underwent primary amputation pass through very smooth course of rehabilitation, they had short hospital stay (so less burden on medical institutions), they got only two surgeries, they had well fitted prosthesis and good physiotherapy and most of them got back to their original works or they change their work according to their capabilities. If we compare this regime of treatment with the experience of the others to decide the importance of amputation decision for example in 1988, Bondurant and associates reported on the cost of limb salvage in open grade IIIB and IIIC tibial fractures, of 263 patients, 43 ultimately underwent amputation. 14 patients had primary amputation and averaged 22, 3 days in the hospital, 1, 6 surgical procedures, and \$ 28.964 in hospital cost, patients who attempts at limb salvage averaged 53, 4 days in the hospital stay, 6, 9 surgical procedures, and \$53.462 in hospital costs<sup>(10)</sup>, the authors suggested that early amputation based on appropriate criteria would improve function, shorten hospitalization, and lessen the functional burden placed on both the patient and the institution<sup>(3)</sup>.

Georgiadis and associates performed a comparable investigation in 1994, they compared results of limb salvage with those of early amputation in 45 patients with open tibial fractures and concomitant soft tissue loss, 27 of whom underwent salvage and 18 early amputation. Amputation was ultimately required for 5 of the 27 limb salvage patients. Limb salvage patients also had more complications and underwent more surgical procedures, resulting in longer hospitalization, than did patients who underwent early amputation. At 35 months follow up, the 16 limb salvage patients available for follow up were less able to work and had significantly higher hospital charges than early amputation patients. In addition limb salvage

patients had more problems with occupational activities, and more of them considered themselves to be disabled<sup>(11)</sup>.

Butcher and associates evaluated disability in 319 patients who had sustained high energy lower limb trauma and compared outcomes at 12 and 30 months. At 30 months follow-up 20% of the patients had not returned to work; 64% of the patients had no disability (as assessed with the sickness impact profile), 17% had mild disability, 12% had moderate disability, and 7% had severe disability. The actual physical impairments at 12 months follow up did not change significantly, and this measure was not predictor of return to work or disability. These results demonstrate that good outcomes can be achieved after significant lower limb trauma, but it is difficult to predict which patients will not have a good outcome<sup>(12)</sup>.

It is imperative that medical decision making be based on medical evidence rather than on financial consideration alone, nevertheless, limb salvage surgeons need to take in to account the economic burden on the patient and the institution in addition to quality of life issue<sup>(3)</sup>.

Hansen and others have noted that when posttraumatic limb salvage patients were candid, they frequently stated that, although their limbs were saved, their lives were ruined by the prolonged and costly attempts at reconstruction. Hansen has termed this approach the "triumph of technique over reason"<sup>(11) (13) (14) (15)</sup>

When massive trauma to the lower limb occurs, the orthopedic surgeon must make difficult decisions. Although treatment has changed significantly over the past years, many of the dilemmas remain the same. It is the obligation of the physician to treat the entire patient and not the limb in isolation. What is technically feasible may not be in the best interest of the patient. Amputation should not be considered a failure but rather another therapeutic modality. To return an individual to preinjury function while limiting pain and suffering in the goal of treatment. If this cannot be accomplished by limb salvage, then amputation must be considered seriously. We hope that ongoing multicenter prospective studies will produce clinically validated guidelines for amputation and salvage<sup>(3)</sup>.

### CONCLUSION:

1- Primary below knee amputation with delayed primary stump closure is superior to limb salvage in compound fractures lower tibia and fibula (Gustilo grade II, III) with bone loss (5 cm and more) associated with complete tibial nerve injury. And it has the same results if there is associated vascular injury.

2- Patient's understanding of the benefits of this type of surgery is very important so it is important to discuss these medical issues in media programs to increase the public knowledge.

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