A score for predicting salvage and outcome in Gustilo type-III A and type-III B open tibial fractures

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Limb-injury severity scores are designed to assess orthopaedic and vascular injuries. In Gustilo type-III A and type-III B injuries they have poor sensitivity and specificity to predict salvage or outcome.

We have designed a trauma score to grade the severity of injury to the covering tissues, the bones and the functional tissues, grading the three components from one to five. Seven comorbid conditions known to influence the management and prognosis have been given a score of two each. The score was validated in 109 consecutive open injuries of the tibia, 42 type-III A and 67 type-III B. The total score was used to assess the possibilities of salvage and the outcome was measured by dividing the injuries into four groups according to their scores as follows: group I scored less than 5, group II 6 to 10, group III 11 to 15 and group IV 16 or more.

A score of 14 to indicate amputation had the highest sensitivity and specificity. Our trauma score compared favourably with the Mangled Extremity Severity score in sensitivity (98% and 99%), specificity (100% and 17%), positive predictive value (100% and 97.5%) and negative predictive value (70% and 50%), respectively. A receiver-operating characteristic curve constructed for 67 type-III B injuries to assess the efficiency of the scores to predict salvage, showed that the area under the curve for this score was better (0.988 (± 0.013 SEM)) than the Mangled Extremity Severity score (0.938 (± 0.039 SEM)). All limbs in group IV and one in group III underwent amputation. Of the salvaged limbs, there was a significant difference in the three groups for the requirement of a flap for wound cover, the time to union, the number of surgical procedures required, the total days as an in-patient and the incidence of deep infection ($p < 0.001$ for all). The individual scores for covering and functional tissues were also found to offer specific guidelines in the management of these complex injuries.

The scoring system was found to be simple in application and reliable in prognosis for both limb-salvage and outcome measures in type-III A and type-III B open injuries of the tibia.

The Gustilo-Anderson classification is the most widely used means of assessing open injuries, but it has many limitations. Following the original classification; the type-III injuries were further divided into type-III A to describe adequate soft-tissue cover of the fracture despite extensive skin loss, type-III B which denoted extensive soft-tissue loss, periosteal stripping and exposure of bone, and type-III C which described an open fracture with an associated arterial injury requiring repair. The definition has since undergone many modifications and there is no uniformity in its description worldwide. Type-III B injuries, which are the most challenging, have a wide spectrum. No guidelines can be drawn using the classification for either management or prognosis (Fig. 1). In type-III B injuries the skin, muscles, nerves and bones are injured to varying degrees. Although the classification focuses mainly on the soft-tissue injury, the extent of the damage to the muscles and bones may be under-represented and of such severity that it influences the final outcome (Fig. 2). The classification is subjective and the inter-observer agreement is also only moderate to poor, highly case-dependent and varies with the experience of the surgeon. There is a growing opinion that this classification is not an adequate basis for making decisions for treatment or for comparing published results. The classification does not address the question of salvage, but reconstruction of a severe type-III B injury can be challenging. The many