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Immediate primary skin closure in type-III A and B open fractures: results after a minimum of five years

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Introduction:

Although a literature search revealed that there have been some reports on primary closure of soft tissue wounds in open fractures, we were unable to find a paper which had the dual advantages of a large series as well as a long follow-up. The focus of the evening was to assess current practice and to analyse if this paper changed current practice. The BOA Guidelines (Blue Book) were also reviewed and strong arguments were made for and against the message contained in this paper.

Paper Review:

The introduction to the paper was fairly concise and stated the aims clearly. The two main aims were to elucidate appropriate indications for direct skin suturing in type-III open injuries. A second aim was to evaluate long term results of direct skin suturing. However, the paper stated that this was a prospective study on the outcome of the immediate closure of type III injuries and that it aimed to develop safe indications for the procedure. On further reading of the paper it was felt that it resembled an audit of treatment rather than a prospective study. In fact the authors' paper published in the journal in 2006¹ reviewed 554 patients with open fractures admitted between February 1999 and February 2001, out of which 109 consecutive open injuries of the tibia were used to validate the Ganga Hospital Open Injury Score. It was felt that there may be some overlap between the cohorts of patients from the 2006 paper and this paper.

Patients and Methods:

The study design was clearly described in the form of a flow chart. It was a prospective audit of a cohort of 185 patients who satisfied the inclusion criteria and had immediate closure of their wounds. Eight patients were lost to follow-up and four died leaving 173 available for evaluation.

Bones involved included tibia, femur, forearm and arm. The majority were the femur (40) and tibia (79).

There was no control group of patients and it was felt that it would have been useful to have a matched control group treated according to current practice either as described in the BOA Guidelines or using a sterile VAC dressing with secondary closure at 48 hours. This would have made it a truly prospective randomised study with level 1 evidence. The methods section then highlighted a common problem with the Gustilo and Anderson classification system which is that there were inherent difficulties in classifying injuries as type-III A or B with high inter- and intra-observer errors, and also because of the frequent modifications of this classification system. Therefore the authors used their own open fracture classification system which was published in the Journal in 2006.¹ Although this system represents an improvement over the older classification system of Gustilo and Anderson, it had only been validated in the reporting centre and multicentre trials would be required to evaluate its effectiveness.

Management Protocol and Inclusion Criteria

The management protocol involved dual care from both plastic and orthopaedic teams and included debridement by a senior surgeon who assessed if the patient met the inclusion criteria. This could therefore result in selection bias where the less severe open fracture is selected for immediate primary skin closure based on previous experience of the operating surgeon. The inclusion criteria were clearly described and included type-III A and B open injuries of limbs without vascular deficit, wounds without skin loss either primarily or secondarily during debridement, Ganga Hospital skin score of 1 or 2 and total score of 10 or less, injury to debridement interval of less than 12 hours, presence of bleeding wound margin that could be apposed without tension and stable fixation. It was not clear how the injury to debridement interval was measured. All patients received tetanus prophylaxis and intravenous antibiotics. Once a satisfactory debridement had been performed, the wounds were then closed with intermittent skin sutures over a suction drainage. Wounds were reviewed at day 2, 4, at removal of sutures, monthly until union and annually thereafter. The tables detailing the assessment criteria for wound healing and final outcome were clear and concise. The type of skeletal stabilisation used was then described and would have been clearer if tabulated as well.

Results:

Follow up and completeness of data

The mean follow up of 6.2 years is certainly long enough to assess outcome. A total of 86.7% had an excellent outcome, 6.4% a good outcome and 6.9% a poor outcome. All upper limb injuries had an excellent outcome, as would be expected. The authors conclude that the presence of bleeding from wound margins that could be apposed without tension was found to be more important than the size, nature or site of the wound or the method of internal fixation. However there was no further explanation as to how this conclusion was reached and it was felt to be a speculative statement.

Wound Healing

The wound review regimen was described in the Methods section and 97.7% of wounds healed without further intervention. One patient had wound necrosis requiring surgical intervention and three patients had wound necrosis requiring flap cover. But it was not clear at what time point these interventions were performed.

Infection

A total of 16 of the 173 patients (9.2%) developed infection. It was superficial in 11 (6.4%) and resolved with antibiotics. Five patients had a deep infection and these were clearly tabulated with details of infective organism, management, time of presentation, secondary procedures and course of infection well documented.

Bony Union

There were 160 of the 173 (92.5%) fractures that united uneventfully. Delayed union was observed in seven patients (4%) and nonunion in six (3.5%). No tests of statistical significance were possible with these outcomes as there was no control group.

Discussion and Conclusions:

The authors state that there is growing evidence that most acute infections after open fractures are due to hospital acquired organisms rather than bacteria from the original injury giving this as a strong indication for primary closure. While this may or may not be the case, it was felt that Vacuum assisted closure (VAC) provided a sterile environment after debridement with reduced risk of secondary infection from hospital acquired organisms. Also previous studies were cited from 1948 and 1992 which show good results after primary closure. However it was felt that these types of injuries involved clean wounds which would have done well anyway. The authors themselves admit that assessment of skin margins requires good judgement and experience. The journal club felt that since theirs was a specialist trauma centre, the authors could adopt this strategy. However, this approach may not be appropriate in an average general hospital with different grades and experiences of operating surgeon. The reason given for not randomising the patients could have been avoided if VAC dressings were employed. Although the authors have done a detailed study in a large patient group with some very good results, further studies preferably with level 1 evidence would need to be done before this message could be adopted in the care of trauma patients. Until that time the current guidelines should be followed.

References

1. **Rajasekaran S, Naresh Babu J, Dheenadhayalan J, et al.** A score for predicting salvage and outcome in Gustilo type-IIIA and type-IIIB open tibial fractures. *J Bone Joint Surg [Br]* 2006;88-B:1351-1360.