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DEBATE

Early versus delayed closure of open fractures

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KEYWORD
Delayed wound closure

Summary Despite convincing data from Ljubljana, Yugoslavia 20 years ago, that emergency free tissue transfer for open fractures results in a low infection rate, shorter hospitalisation, decreased time for bone healing, and low incidence of flap failure, there are circumstances that preclude against immediate wound closure. The case for delayed wound closure is made based on several parameters that include: surgical team availability, the condition of a patient, and adequate informed consent. Delayed wound closure is the rule and emergency free tissue transfer is the exception, in major trauma centres around the world. There is a difference between immediate, delayed, and late coverage and these terms have yet to reach universal acceptance. The demographics of reconstructive surgery are changing in terms of surgeons having the skill sets, desires, and incentives to perform complex reconstruction for open fractures. This issue will perhaps be the most telling characteristic of what happens as we go forward into the future of trauma care and the timing of wound closure.

The controversy surrounding early versus delayed closure of open fractures has been an ongoing debate for at least 20 years, since Marco Godina published his landmark paper on the subject of emergency free flaps.[1,2] The article was published posthumously and it described Godina's experience with 134 consecutive open fractures. There was a 1.5% deep infection rate in this series, which were treated with emergency free tissue transfer. Godina tried to categorise emergency free tissue transfer, by defining it as the definitive coverage procedure performed at the time of the initial debridement. The patient would present to the emergency room with an open fracture. Fracture stabilisation and coverage would be done in the 1st operative setting. In scrutinising the data, the patients that had emergency free tissue transfer, (that is a flap done at the first setting) compared with those who had a flap at 3 days, this did not show any difference in infection rates. It was emphasised that the surgeons lacking experience with debridement, and patients who had longstanding open wounds, did not do as well, in terms of infection rate and limb salvage after coverage.[5] Furthermore, the longer coverage was delayed, the longer time was spent in hospital, either at outside referring institutions or even within Ljubljana. One would have thought that 20 years ago, that such convincing data, would have influenced orthopaedic surgeons and reconstructive microsurgeons, to change how open fractures are managed. In some centres this has been the case, but the fix and flap idea is still not mainstream thinking.

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Currently, the closure of open fractures and techniques associated with coverage are rarely in the hands of orthopaedic surgeons or traumatologists. Historically, many orthopaedic surgeons were involved with free tissue transfer. Many orthopaedic surgeons pioneered techniques in microvascular surgery, as they relate to replantation, vascularised bone transfers, and free tissue transfer. Limb salvage after trauma, tumour, and orthopaedic sepsis (osteomyelitis) were forever changed with the introduction of the operating microscope and development of autologous tissue transfer.[9] Today microvascular free tissue transfer is available in most major trauma centres. However, a profound change has occurred over the last 25 years: fewer and fewer orthopaedic surgeons are capable or willing to perform free tissue transfer. Subsequently, microvascular free tissue transfer and sophisticated techniques such as fasciocutaneous flaps or perforator flaps (either rotational or free) have been relegated to "soft tissue surgeons" many of whom are reconstructive plastic surgeons. Furthermore, the interest of those that are keenly interested in reconstructive surgery or reconstructive microsurgery has diminished in plastic surgery, there are fewer and fewer surgeons who are willing to perform complex microsurgical extremity reconstruction. Even more frightening, is the suggestion that microsurgical techniques are "no longer needed", because alternatives such as dermal substitutes, wound VACS, and local rotational flaps will substitute or provide better coverage than free tissue transfer. I strongly disagree with this.

While the wound VAC has taken its place in the armamentarium of lower extremity coverage for open fractures, in my estimation it has replaced wound temporisers and wound "bridging" that we used in the 80's such as the bead pouch. Many authors have demonstrated that the wound Vac can treat a soft tissue defect associated with an open fracture to completion, by facilitating secondary intention healing, the VAC stimulates granulation tissue, that ultimately will epithealise, or support a skin graft, obviating the need for more complex reconstruction.[3] To me this is a triumph of "technology over reason" and it is fraught with potential disasters. Bacterial colonisation and late infection of implants, bone, and plates and screws can lead to osteomyelitis, if the VAC is used for prolonged periods, especially when plates and bone are exposed.

If one is to address the controversy of early versus delayed closure of open fractures, we should define what early versus delayed means. This has been debated for some time.[2] Do we mean by early, at the same setting as primary debridement, within 3 days, within 1 week, within 2 weeks, or more? Delayed coverage may be defined as anytime after the initial debridement; the delay may last weeks or months.

While I believe in the principles that Marco Godina published in his thesis, and recognise him to be a brilliant contributor to modern concepts in wound closure and microvascular surgery, the days of Godina's team in Ljubljana are different from what exists today in healthcare systems around the world. Marco Godina had a tireless crew of dedicated reconstructive surgeons and reconstructive microsurgeons who worked around the clock in teams, to provide expert and highly successful microvascular tissue transfers. Part of the rationale was that there was so much work to be done, that these cases would have to be done urgently, because more cases would be presenting later on. When there is a replant or microvascular team available in an institution around the clock, there is no reason why early or even emergency free tissue transfer cannot be performed. The reality is, that this is not practical in most centres around the world and certainly not in North America, due to the diminished interest in microsurgery by orthopaedic and plastic surgeons. Open fractures often present during the hours of 10 p.m.—7 a.m., therefore, delayed closure of open fractures has become the rule. This does not mean the delay is for weeks or months, but as Godina stated in his paper, up to 3 days will provide a good outcome. In our institution, our microvascular team will examine the patient at time of the initial debridement, and perhaps during the placement of external fixation, with plans to immediately return the patient to the operating room for a "second look" sometimes after 24 or usually 48 h.[8] At that time, provided the first debridement is radical, there may be a second requirement or second touch up debridement and then the patient will be closed at that sitting. Closure does not always involve microvascular free tissue transfer. There can be secondary intention wound healing, application of a wound vac with granulation tissue that is allowed to epithealise, application of a wound VAC to create a bed suitable for split thickness skin graft, skin grafting in and of itself, local rotational flaps or free tissue transfer.[7]

A BOA BAPS combined report published in 1997 reviews modern principles of management for open tibial fractures.[13]

Furthermore, as Godina taught us 20 years ago, it does not matter if a wound is closed within 24 or 72 h, the results in terms of infection are the same.

In 'delayed cases', which is defined as dehiscence following emergency treatment, there are several factors to be covered. If there is infected hardware,