

Autologous Platelet-rich Plasma in the Conservative Management of a Traumatic Foot Injury with Impending Gangrene in a Pregnant Patient: A Case Report

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ABSTRACT

Musculoskeletal trauma during pregnancy presents a dual challenge, as both the maternal management and foetal safety should be balanced together. This condition presents a challenge in the use of ionising imaging, anaesthesia and operative fixation. Autologous Platelet-Rich Plasma (PRP) can present as a better alternative for wound management in these conditions. This is a case of a 34-year-old female with 31-week gestation presented to the casualty department for the management of an incomplete traumatic amputation of the little toe of the left foot and a laceration over the dorsum. The distal part of the toe was dusky and poorly perfused, consistent with impending gangrene. Radiographical assessment (abdominal lead-apron shielding) showed a comminute fracture of the head of the fifth metatarsal and a fracture of the distal phalanx of the fifth toe. The wound was cleaned, debrided, with stay sutures placement followed by the initiation of the autologous PRP therapy. The initially non-viable-appearing wound demarcated and granulated over the PRP course, and the toe was salvaged; the wound subsequently healed completely by secondary intention under topical recombinant human epidermal growth factor and mupirocin dressings. She delivered a healthy female neonate at term. Follow-up at one year showed a gradual foot healing and weight-bearing. Autologous PRP combined with meticulous wound care might be associated with salvage of a devascularised digit with impending gangrene in pregnant females with non-feasibility of operative fixation. Hence, it can be recommended as a low-risk adjunct for wound healing in pregnant patients with limited surgical options.

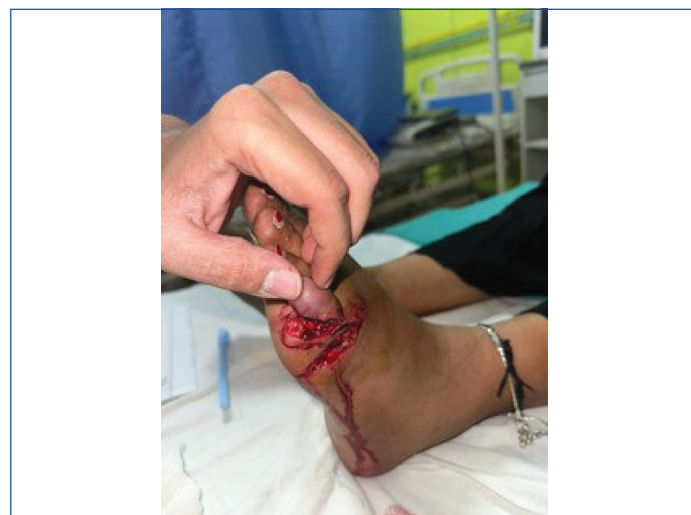
Keywords: Conservative treatment, Foot injuries, Gangrene, Pregnancy, Wound healing

CASE REPORT

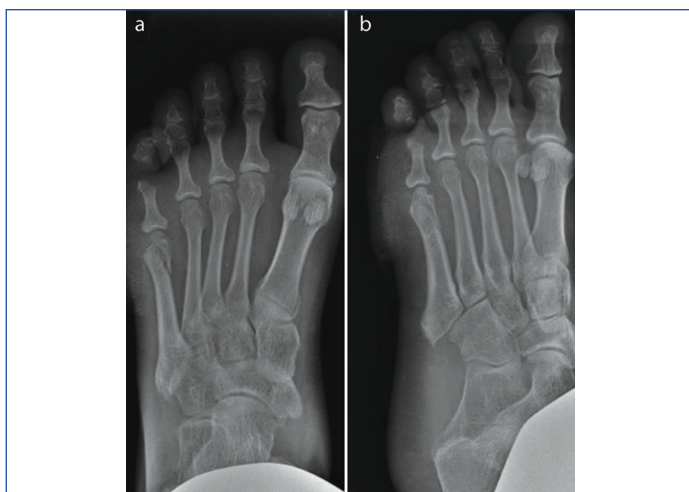
A 34-year-old with primigravida (G1P0) presenting with 31 weeks gestation and under regular antenatal care, was brought to the casualty department following left little toe injury. She was pillion rider on a two-wheeler with the left foot positioned outward after direct lateral impact followed by fall; an oncoming two-wheeler struck the left little toe directly from the lateral side (direct lateral impact to the digit).

On arrival, the primary survey was unremarkable and she was haemodynamically stable. There was a head injury, but the Magnetic Resonance Imaging (MRI) brain showed an extracalvarial soft-tissue swelling in the right parietal region which was suggestive of a subgaleal haematoma, with normal brain parenchyma and no intracranial abnormality. The gynaecological and obstetric assessment was reassuring, with stable foetal heart rate and no uterine contractions or per-vaginal bleeding. Local examination of the left foot showed an incomplete traumatic amputation of the little (fifth) toe, remaining attached by only an ~1 cm dorsal skin tag with dorsolateral laceration of ~4.5 cm. The wound was open and contaminated with no active purulent discharge. There was dusky discoloration of the toe noted on examination. The distal portion of the toe appeared dusky with sluggish capillary refill, findings consistent with vascular compromise and impending gangrene. Vascular assessment showed that the vascular compromise confined to the injured digit (zone of injury), with a well-perfused foot proximally [Table/Fig-1]. Baseline blood investigations were within the normal limits. Radiological assessment of the left foot (anteroposterior and oblique view) was obtained with the abdomen shielded by a lead apron to minimise foetal radiation exposure which demonstrated a comminute fracture of the head of the fifth metatarsal and a fracture of the distal phalanx of the fifth toe [Table/Fig-2].

Attributed to the compromised and contaminated soft-tissue envelope, closed reduction and internal fixation with a Kirschner wire was not undertaken, to avoid both intraoperative fluoroscopy and the placement of hardware within a devascularised, potentially infected wound bed. Under local anaesthesia, the wound was thoroughly irrigated and debrided, and stay sutures were placed to approximate and support the near-amputated toe [Table/Fig-3]. Broad-spectrum antibiotic and tetanus prophylaxis as per the pregnancy protocols and limb elevation were in consultation with the obstetric team. She was further managed by a course of autologous PRP. A volume of 20 mL of the venous blood was collected and processed by double spin centrifugation to yield approximately 4 to 5 mL of PRP, and injected into the wound under aseptic condition



[Table/Fig-1]: Clinical presentation of the injured last digit of the left foot.



[Table/Fig-2]: X-ray image showing disruption of the fifth toe phalanges and fifth metatarsal head fracture; a- Dorsoplantar, b- Oblique view.



[Table/Fig-3]: Presentation after the placement of stay sutures.

with local anaesthetic spray. This was scheduled every 4th day for a total of seven sessions. Topical agent- recombinant human epidermal growth factor gel and mupirocin 2% ointments were applied [Table/Fig-4].



[Table/Fig-4]: Sutured wound with the transverse suture line, dusky/blackening little toe, dorsal serous blister, necrotic strip forming along the suture line (After 1st PRP); a- Dorsolateral view, b- Wide dorsolateral view.

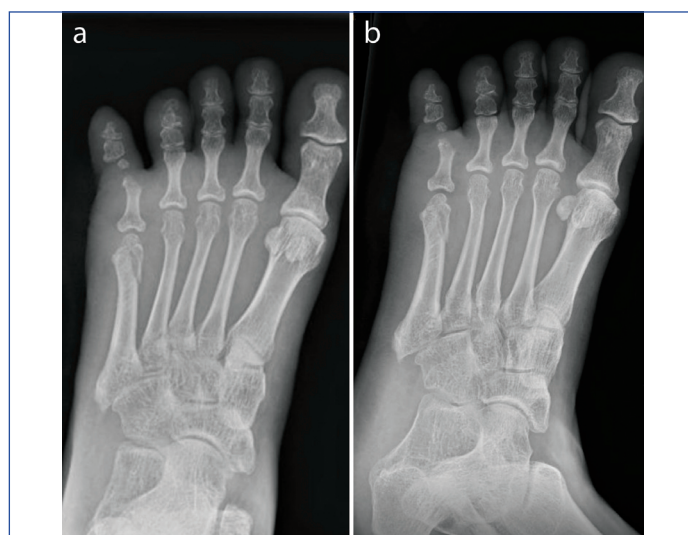
The wound dressing was changed every 3rd day until two months. The wound, which had initially shown features of impending gangrene, gradually demarcated and developed healthy granulation tissue over successive PRP cycles, without progression to frank gangrene or the need for amputation [Table/Fig-5]. Three-month follow-up showed the last toe healing well [Table/Fig-6]. The wound healed by secondary intention and the little toe was salvaged. The pregnancy continued uneventfully, and the patient subsequently delivered a healthy female neonate at term. At the latest follow-up, at one year, the foot was well healed the patient was comfortably weight-bearing [Table/Fig-7].

DISCUSSION

Foot injuries and ulcers remain crucial and might result in adverse outcomes such as gangrene and amputations [1]. It is more important



[Table/Fig-5]: Wound showing improvement after 7th PRP session.



[Table/Fig-6]: X-ray at 3-month follow-up, a- Dorsoplantar, b- Oblique view.



[Table/Fig-7]: 12-month follow-up image of the foot showing a healthy recovery and good weight bearing.

in co-morbid conditions such as diabetes as it presents significant health threats. The platelet concentrates are helpful in enhanced tissue repair and better wound healing [2,3]. Platelet concentrates such as PRP, platelet-rich fibrin and concentrated growth factors work as natural materials which can be utilised for its regenerative potential [3]. There are multiple evidences reporting PRP use for better wound healing and faster recovery [2,4]. But there is very limited for its use in pregnant females in context of wound healing. Autologous PRP has recently emerged as a useful biologic adjunct in foot and ankle practice. It has been studied for tendon, ligament, cartilage, muscle, wound, and bone healing, including fracture repair and fusion procedures. Its proposed benefit is based on the delivery of concentrated autologous platelets and growth factors that may enhance tissue repair at the cellular level [4]. Research evidences suggest that PRP plays an important role in the promoting bone healing and repair in different foot and ankle surgeries [5]. PRP is also among the suggested treatments for vasopressin-induced gangrene which can be attributed to the activated platelets which

provides a variety of growth factors, which in turn promote tissue regeneration and help chronic wound healing. Though, timely recognition and intervention is essential [6]. Additionally, autologous PRP with thrombin gel in split-thickness skin graft significantly shortened healing time with improved outcomes [7].

A case of a 20-year-old female with limited therapeutic options was reported by Pundker A et al., showed reversing of digital ischaemia possibly by PRP infiltration which in turn favoured tissue perfusion and preventing further necrosis [6]. A retrospective case-control study in diabetic patients showed postoperative necrosis in 28% versus 64% in L-PRF treated and control group with p-value=0.011; and similarly postoperative infection were noted as 24% and 56% (p-value=0.0211) in L-PRF and control group respectively [8]. PRP-therapy can be considered relatively cost-effective and minimally invasive, and safe to be utilised in most of the patient cohorts. Decade old evidence reported by Mehrannia M et al., showed that PRP-can be associated with good healing potential for foot ulcers and prevention of adverse outcomes such as amputation and re-amputation. As the chances of re-amputation are significantly increased in patients with amputation. This was demonstrated by case of a 71-year-old male with long history of diabetes, treated by PRP-therapy and showed good recovery in six weeks and satisfactory healing by the end of eight months [9]. All the clinical evidences suggest the use of PRP in non-pregnant patients but evidence is not established in pregnant patients. This case illustrates the constraints that pregnancy places on the orthopaedic management which might be a straightforward forefoot injury in non-pregnant patients. The treatment was defined on the basis of the deferral of internal fixation, and the use of an autologous biological adjunct to rescue a devascularised wound [6,10].

The reluctance to proceed with Kirschner-wire fixation across a contaminated wound with impending gangrene risks converting a marginal wound into a deep infection, and internal fixation through a non-viable soft-tissue bed is generally avoided. Pregnancy added a second layer of caution as the closed reduction of metatarsal and phalangeal fractures typically relies on intraoperative fluoroscopy, and although foetal dose from a shielded distal-extremity study is very low. Hence, autologous PRP was chosen, which offered a way to address the principal threat to the limb, namely the poorly perfused, impending-gangrenous wound. The concentrated growth factors released by activated platelets stimulated angiogenesis and fibroblast activity, which in turn improved the local perfusion and drive granulation in a compromised wound bed [1,10]. PRP has been studied as an adjunct in chronic, diabetic and traumatic wounds, and its autologous nature makes it particularly suitable in pregnancy, where exogenous pharmacological wound agents are best minimised. PRP in this case helped in arrest and reversal of gangrene and the subsequent dressings with recombinant human epidermal growth factor and mupirocin helped in recovery. In this

case the sequence of demarcation, granulation and healing over seven cycles, without progression to frank gangrene, is consistent with a favourable local response. It is worth emphasising that PRP was one component of a multimodal, multidisciplinary approach undertaken jointly with the obstetric team, rather than a stand-alone therapy. Though, only a single case cannot establish causation. Nonetheless, the case adds to the literature on the use of autologous PRP for limb salvage in circumstances where conventional surgical options are limited, and it supports consideration of PRP as a low-risk adjunct in the pregnant patients with a compromised traumatic wound.

CONCLUSION(S)

Autologous PRP is an accessible, low-risk biological adjunct that merits consideration as part of a multidisciplinary limb-salvage strategy in patients with limited surgical choices. It successfully helped the management of an incomplete traumatic amputation of the little toe and a dorsal foot wound showing impending gangrene in a pregnant female. Though, large studies are needed to define and establish the evidence in this patient cohort.

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