Section: PMR

Case Series

ROLE OF AUTOLOGOUS PLATELET RICH FIBRIN IN PRESSURE INJURY HEALING IN SPINAL CORD INJURY- A CASE SERIES

Padma Rani S[1], Mangaiyarkarasi A[2]

[1]Assistant Professor of PMR, Coimbatore Medical College & Hospital, Coimbatore, Tamil Nadu, India.
[2]Professor and HOD (Retired), Blood Bank and Transfusion Medicine, Coimbatore Medical College Hospital, Coimbatore, Tamil Nadu, India

Received : 15/01/2026
Received in revised form : 21/02/2026
Accepted : 12/03/2026

Keywords:
Platelet Rich Fibrin (PRF), Biological healing, Spinal Cord Injury.

Corresponding Author:
Dr. Padma Rani S,
Email: padmarani795@gmail.com

DOI: 10.47009/jamp.2026.8.2.193

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (2); 1052-1056

ABSTRACT

Background: Patients with Spinal Cord Injury are liable to develop Pressure Injuries. The Pressure Injuries are often associated with high morbidity, expensive and prolonged treatment involving emotional burden of patient and caregiver. This is one of the deleterious effect of inactivity and prolonged friction. The aim of this study was to determine the efficacy of Autologous Platelet Rich Fibrin (PRF) in the management of Pressure Injury in Spinal Cord Injury. **Materials and Methods:** 5 patients with Pressure Injury who had already sustained Spinal Cord Injury were included(n=5).The Pressure Injuries were treated with PRF applied weekly twice .The response to treatment was recorded by calculating the following parameters pre and post PRF 1)The area of pressure injury at baseline and at subsequent visits till the ulcers healed.2)NPIAP Scoring 3)Wound size 4)PUSH Score 5)SCI-PUMT Score 6)Wound volume 7)Functional Independence Measure 8) Wound Culture and Sensitivity. **Results:** This study included 5 Spinal cord injured patients with Pressure Injury. Out of five -2 Ischial ,1 Sacral,1 Trochantric, 1 Malleolar Pressure Injuries were included. The Mean area of the ulcers was 5 cm^2 and mean duration of healing was 3.2 weeks. The Mean age of the patients was 40.6 years. The minimum and maximum sittings required were 3 and eight respectively (mean-6.4). No adverse reactions were noted. The Mean wound Healing time was 3.2 weeks. **Conclusion:** The concept of biological healing in a regenerative way in a Pressure Injury is a novel and therapeutic approach in an economical, versatile, simple evidence based method.

INTRODUCTION

The incidence of pressure injury in spinal cord injury (SCI) is 23% and 30% of individuals experience one annually, while up to 85% may develop one over their lifetime.[2] A significant number of these ulcers, about 30–40%, occur during the initial acute and rehabilitation phases.[19]

Platelet-Rich Fibrin is a second-generation platelet concentrate derived from the patient's own blood, prepared without the use of anticoagulants or artificial additives. Unlike earlier platelet concentrates, PRF forms a natural fibrin matrix rich in platelets, leukocytes, cytokines, and growth factors. This three-dimensional fibrin scaffold acts as both a reservoir and a slow-release system for biologically active molecules that play a crucial role in wound healing, angiogenesis, and tissue regeneration.

Pressure injuries remain one of the most common and debilitating secondary complications in individuals with spinal cord injury (SCI).[11] Beyond prolonged immobility, the development of pressure injuries in SCI reflects a complex interplay of mechanical, neurological, vascular, and inflammatory factors.[12] The loss of protective sensation and voluntary motor control following SCI exposes tissues to sustained pressure and shear forces, often without the individual's awareness, allowing tissue damage to progress silently.[13]

MATERIALS AND METHODS

Autologous platelet-rich fibrin (PRF) matrix is a regenerative biomaterial created from a patient's own blood to accelerate wound healing and tissue regeneration. It is made by centrifuging whole blood without an anticoagulant, which separates it into distinct layers, with the middle PRF clot containing a dense fibrin network rich in platelets, growth factors, and leukocytes. This matrix acts as a natural scaffold, releasing growth factors that stimulate tissue repair and regeneration

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Patient Selection

Five Spinal cord injured Patients with Pressure Injury of any duration were recruited after written informed consent. Patients with bleeding disorders, Thrombocytopenic with platelet count less than 1 lac /mm 3, patients on anticoagulants(spirin, warfarin, heparin), pregnant lactating women, deep ulcers with exposed bone/tendon (NPIAP Grade 4),severe hypoproteinemia (<6 g/dl),pregnant and lactating women were excluded from the study.

Methodology

After taking detailed history and clinical examination, baseline wound swabs were sent and they were positive for 2 patients who were started with appropriate antibiotics rationally.

- **Type: PLATELET RICH FIBRIN-LYMPHOCYTE RICH**
- **Source**: Autologous
- **Method of isolation:** Under strict aseptic precautions -10 ml of patient venous blood was withdrawn in a plain sterile vacutainer and immediately Centrifugation done by Single spin-3200 rpm *10 minutes (no anticoagulant) in REMI 8C (6)(Insert Figure-1).

Three layers were obtained after Centrifugation comprising of Platelet poor upper plasma, middle PRF, Lower RBC sediment.PRF was separated by using sterile blade and forceps

- Site & Mode of application-Placed over Pressure injury base/ using sterile gauze and forceps covered by non-adhesive dressing /sterile roller bandage and left in place for 3 days. (Insert Figure 2)
- Number of sessions-weekly twice. The Bandage was changed in next session.
- Out of five-2 patients were diabetic and was followed up for strict glycemic control and insulin adherence and oral antibiotics.
- The Percentage reduction in Wound size, volume, area were assessed in every session and compared. The area was calculated by superimposing a graph paper over the transparency as recommended by Orien et al,[5] (Insert Figure 3)
- Weekly follow up of wound parameters done (Insert Figure 4)
- The SCI PUMT, PUSH tool, FIM Score, NPUAP Staging were also recorded Pre and Post treatment and tabulated.(Insert Figure 5)

Post Procedural care

- Medications- Iron supplements, Astymin, Baclofen, Vitamin C supplement
- Rehabilitation-Comprehensive SPINAL CORD INJURY Rehabilitation on process/Alpha bed/SCI rehabilitation SOP followed.
- Follow up schedule-weekly twice*8 weeks
- Challenges faced

1. Offloading difficulty
2. Posture maintenance
3. Persisting sensory impairment
4. Associated spasticity

RESULTS

Five Spinal Cord Injured Patients(n=5)-All 5 with complete spinal cord Injury,2 were tetraplegic,3 with High Paraplegia ; Out of Five-4 were males and 1 female included. All 5 with ASIA A grading, 2 Ischial,1 Sacral,1 Trochantric,1 Malleolar Pressure Injury were treated. Demographic details were listed in Table 1(Insert Table 1)

At initial presentation, the Mean Sixe of the ulcers was 5 cm2(range, 3-7cm2). Mean duration was 22.4 days (12 to 30 days). The mean age of the patients was 40.6 years (range, 16 to 53) .The Mean number of sessions were 6.4 (range ,3 to 8).The Mean Healing time was 3.2 weeks (range, 1.5 to 4) (Insert Graph 1)

National Pressure Injury Advisory Panel (NPIAP) Staging,[20] SCI PUMT-Spinal Cord Impairment Pressure Ulcer Monitoring Tool; PUSH –Pressure Ulcer Scale for Healing were recorded Pre and Post PRF sessions and mean values were represented in the graph (Insert graph 2)

None of our patients experienced any form of adverse effect during the 8 weeks follow up period. There was partial recurrence at the same site after 7 weeks in a Diabetic patient, triggered after outstation travel. The Original size of the ulcer was in proportionate with the Healing duration is another observation from the study.

Figure 1: Centrifugation Process

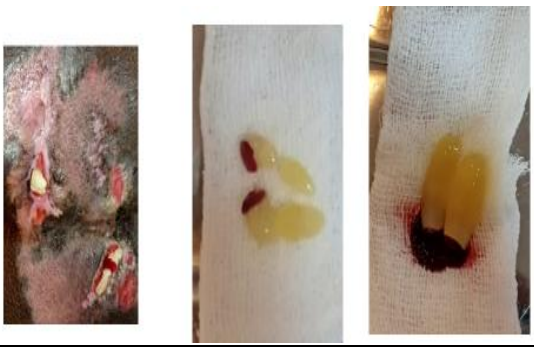


Figure 2: PRF harvesting and placing in wound bed

ISSN (O): 2687-5365; ISSN (P): 2753-6556

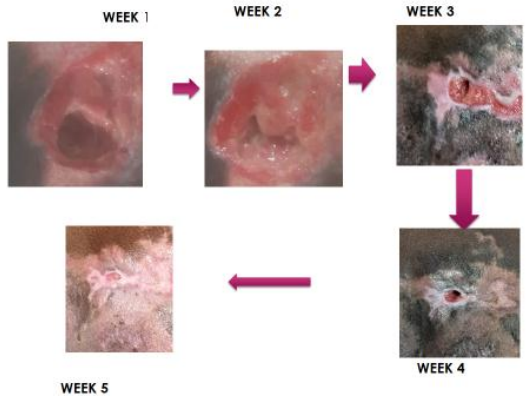


Figure 3: Wound healing pictures weekly basis

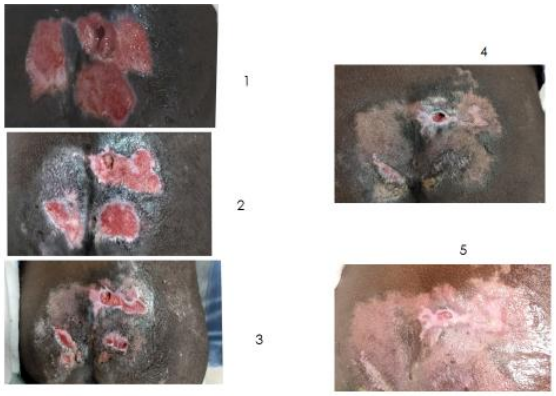


Figure 4: Serial Images of Wound Healing with PRF

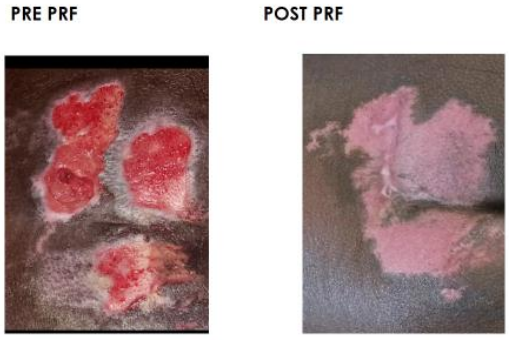
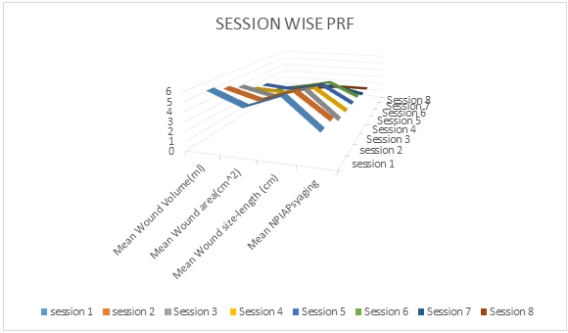
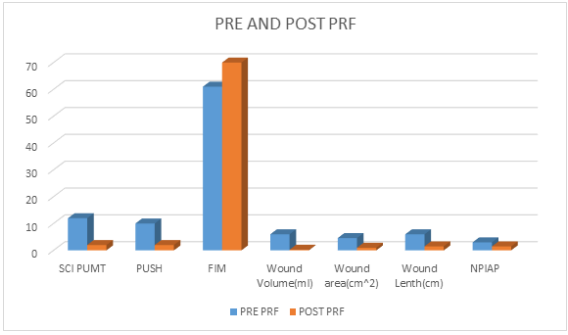


Figure 5: Comparative Pre and Post treatment Images



Graph 1: Session wise PRF Assessment



Graph 2: Comparative variables Pre and Post PRF Treatment

Table 1: Tabulations of Wound Parameters

Age/Sex	Level of Injury	Duration (days)	Site	Area($cm^{2)}$	Sessions treated	Healing time (weeks)
39/M	D12	12	Ischial	4	6	3
16/M	C5	15	Sacral	7	8	4
44/F	D8	30	Trochanter	3	3	1.5
51/M	D 5	25	Malleolar	5	7	3.5
53/M	C5	30	Ischial	6	8	4

DISCUSSION

Healing is one of the body's most remarkable abilities. From a minor cut to complex tissue injury, the human body relies on a finely coordinated biological process to repair and regenerate itself. Modern medicine increasingly seeks to support and enhance this natural healing potential rather than replace it. In this context, Platelet-Rich Fibrin (PRF) has emerged as a simple yet powerful biologically active material that harnesses the body's own resources to promote tissue regeneration.

What makes PRF particularly appealing is its simplicity, biocompatibility, and autologous nature. By closely mimicking the body's physiological healing process, PRF provides an ideal environment for cell migration, proliferation, and differentiation.

At a pathophysiological level, prolonged external pressure over bony prominences compromises capillary blood flow, leading to tissue ischemia,

ISSN (O): 2687-5365; ISSN (P): 2753-6556

impaired lymphatic drainage, and cellular hypoxia.[14] In SCI, this process is further aggravated by autonomic dysfunction, which disrupts normal vasomotor control and thermoregulation, reducing the skin's ability to adapt to mechanical stress.[15] Reperfusion injury following intermittent pressure relief, along with altered inflammatory and immune responses, contributes to microvascular damage and progressive tissue necrosis that often begins in deep tissues before becoming visible at the skin surface.[16] Clinically, these pathophysiological mechanisms explain the rapid onset, atypical presentation, and high recurrence rates of pressure injuries in the SCI population]. Pressure injuries significantly increase morbidity, prolong hospitalisation, delay rehabilitation, and negatively impact quality of life. A clear understanding of the underlying pathophysiology is therefore essential for early risk identification, targeted prevention strategies, and the development of effective therapeutic interventions. In the context of multidisciplinary and regenerative care, addressing pressure injury pathophysiology is central to improving long-term outcomes for individuals living with spinal cord injury.[18]

Few Authors in Cochrane review says that PRF did not significantly accentuate healing, further powered studies are required. Dohan Ehrenfest et al.[17] PRF is evolving as a second generation platelet derived product and it has been used by many authors for healing ulcers of various etiologies like Hansen's disease, Neuropathic ulcers, Vascular ulcers, non healing cutaneous ulcers, Dental, Oral Maxillofacial applications.[1,3,4] But sill the evidences are lacking on the usage of PRF for Pressure injury Healing in SCI. Raktim Swarnakar et al has recommended the usage of PRF to accentuate wound healing in SCI by applying PRF weekly once. Byrne et al described the major risk factors for pressure ulcer in spinal cord disabled.[7] Chan and Lala et all described the average cost of pressure ulcer management and its impact on individuals with SCI.[8,9]

The risk remains elevated in the years following injury, with 30% still reporting an incidence 3 to 4 years post-injury. The available evidence consolidation is as follows

- Level 1 – PI in SCI as global burden
- Level 2-Hospital Acquired PI in acute SCI
- Level 3-Predictors of Hospital acquired PI in SCI
- Level 4-PI and management after SCI
- Level 5-Role of PRF in PI healing in SCI

The Indian scenario with insufficient evidence made us to pursue this study enabling us to provide a novel therapeutic care at affordable cost by General Public in a Tertiary care institution in Taminadu, India. To our knowledge this is the first study as a case series to describe the efficiency of Pressure Injury Healing in SCI in natural painless scientific way. The notorious pattern of PI is recurrence ,for which also the patients are still kept under follow up after proper Education and awareness to Patient and caregiver.

Why PI is more considerative in SCI?

- Immobility
- Motor and Sensory impairments
- Changes in Skin Composition
- Prolonged Hospital Stay
- Neurogenic bladder and bowel
- Autonomous dysreflexia

Scientific basis for regenerative approach

- Growth factors-VEGF, PDGF, EGF helps in tissue repair, regeneration and growth
- Fibrin matrix acts as scaffold for growth factors
- Cellular support-MSC
- Angiogenesis
- Prolonged and sustained biological effects

Comparison with conventional treatments

- Non chemical method
- Biological
- Non invasive, safe
- Cost effective
- Faster healing
- Less wound infection
- Faster recovery

CONCLUSION

PRF helps in reducing healing period, removing debris and microbes by neutrophils thereby helping to hasten inflammatory phase to improve General well being and perineal hygiene. Early Rehabilitation can be initiated. Patients' confidence level has been enormously enhanced. There is an option of cure to pressure ulcer healing in customized cost effective way. PRF for pressure ulcer healing in SCI has been rarely reported in INDIA which should be ideally promoted in evidence based manner in order to welcome future studies en route to Versatile biological way of healing. Patient Education is the Key to help healing and reducing the Emotional Burden. As interest in minimally invasive and biologically driven therapies continues to grow, PRF represents a shift toward patient-centred regenerative strategies—where healing is guided not by synthetic materials, but by the body's own regenerative potential.

Consent to Participant declaration-obtained

Funding Declaration: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgement: Interdepartmental co operation has been achieved between Department of Physical Medicine and Rehabilitation and Department of Transfusion Medicine in providing prompt patient care.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556

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ISSN (O): 2687-5365; ISSN (P): 2753-6556