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Case Report

Efficacy of Amniotic Membrane Use in Chronic Wound Treatment

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ABSTRACT

This study investigates the application of human amniotic membrane in chronic wound care, focusing on its efficacy in promoting tissue regeneration and reducing the need for surgical interventions. Chronic wounds, often associated with comorbidities such as diabetes and vascular diseases, present significant treatment challenges. Human amniotic membrane, an avascular structure rich in extracellular matrix components and growth factors, offers a promising solution due to its immunomodulatory and regenerative properties. The study includes seven patients treated with human amniotic membrane for chronic wounds at a specialized wound care unit. Treatments were conducted over one to two-week intervals, emphasizing the importance of sterile application and consistent follow-up. Outcomes demonstrated significant wound size reduction, accelerated granulation and epithelialization, and minimized need for complex surgeries. Patients with comorbidities particularly benefited, showing improved wound bed preparation for simpler reconstructive procedures. Despite the promising results, limitations such as small sample size and lack of a control group were noted. The findings align with existing literature but emphasize the need for standardized protocols and further large-scale, controlled studies. Overall, human amniotic membrane demonstrates potential as a cost-effective, innovative therapy in chronic wound management, bridging gaps between conservative and surgical approaches.

INTRODUCTION

A wound is defined as tissue loss caused by skin, mucosa, or subcutaneous tissue damage due to physical, chemical, thermal, mechanical, or biological factors.[1,2] Acute wounds generally heal through a predictable process involving four stages: Hemostasis, inflammation, proliferation, and maturation.[2-4] These wounds differ from chronic wounds, which result from a disruption or prolongation of one or more of these phases, often due to conditions such as diabetes, obesity, vascular diseases, or immune deficiencies. These comorbidities complicate treatment and increase the need for multidisciplinary care.[5,6]

The primary goal of chronic wound management is to address the underlying etiology, since untreated causes can lead to recurrence. In addition to managing the causes, supplementary measures such as infection control, moisture balance, and biofilm removal are crucial for effective treatment. Innovative approaches that have shown promise in this area include advanced dressings and adjunctive therapies like negative pressure wound therapy and hyperbaric oxygen therapy.[1,5-7]

The amniotic membrane, an avascular stem cell source containing collagen and extracellular matrix components, is gaining attention for its wound-healing properties. It supports microbial defense, promotes cell migration, and facilitates tissue regeneration while maintaining a moist environment and reducing inflammation and pain.[1,8] The use of amniotic membrane has shown potential in diverse chronic wound types, including diabetic foot ulcers and trauma-related defects.[1,9]

This study evaluates the efficacy of the amniotic membrane in chronic wound care, focusing on its potential to reduce the need for surgical intervention and the cost of

Table 1. Demographic, clinical characteristics and treatment outcomes of cases

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age	44	65	18	64	47	54	37
Sex	M	M	W	M	M	M	W
Comorbidities	-	DM, PAD and CHF	-	DM	DM and PAD	-	DM
Treatment	Conservative	Surgery	Surgery	Surgery	Surgery	Conservative	Surgery
Recurrence	+	-	-	+	-	+	-
Duration of Hospital stay	3 months	2 months	1 month	6 weeks	5 weeks	7 weeks	2 months

treatment. However, while this use of amniotic membrane is promising, further research is needed to establish its definitive advantages over traditional methods and its role in optimizing outcomes in chronic wound management.

CASE REPORT

The study included seven patients who had chronic wounds and were hospitalized patients. The applications were performed at intervals of one to two weeks in accordance with the literature. The average number of human amniotic allograft applications was determined to be two sessions. Patients were hospitalized for the application of the amniotic allograft, while follow-up was planned on an outpatient basis. Care was taken to ensure that bacterial tissue culture was negative before the application. The acute phase reactants and vital signs of the patients were regularly monitored during the applications. Patients were also periodically evaluated for potential side effects related to their procedures. Under sterile conditions in the operating room, a cryopreserved amniotic membrane (Stembio®) was applied to the defect site. Following minimal debridement, viable granulation tissue was preserved to the greatest extent possible, and the membrane was carefully adapted to conform to the wound bed. A pressure dressing was then applied, and the wound was left undisturbed for the first three days to allow adequate graft adaptation before the initial dressing change. The outcomes were assessed in terms of reduced need for surgery, decreased wound size, shortened hospital stays, and less time elapsed before returning to social life (Table 1).

Case 1

A 44-year-old male patient was found on follow-up to have a tissue defect containing total dermis loss of 5x1 cm extending from the flexor zone 1 to 2 of the second finger of the left hand after trauma. The patient had no known comorbidities, and there was no growth in the bacterial tissue culture obtained from the patient. Before applying human amniotic allograft, necrotic areas in the defect were surgically debrided. After debridement, the human amniotic allograft was applied to the viable tissue under sterile conditions. No allergic reactions were observed during follow-up. Two weeks later, the defective area was found to be epithelialized. No additional surgical procedures were performed (Fig. 1).

Case 2

A 65-year-old male patient was found on follow-up to have a tissue defect measuring 12x5 cm in the posterior left lower leg, including dermis and subcutaneous fat tissue loss. A bacterial tissue culture obtained before the procedure showed Pseudomonas aeruginosa growth, which was treated with piperacillin/tazobactam in accordance with

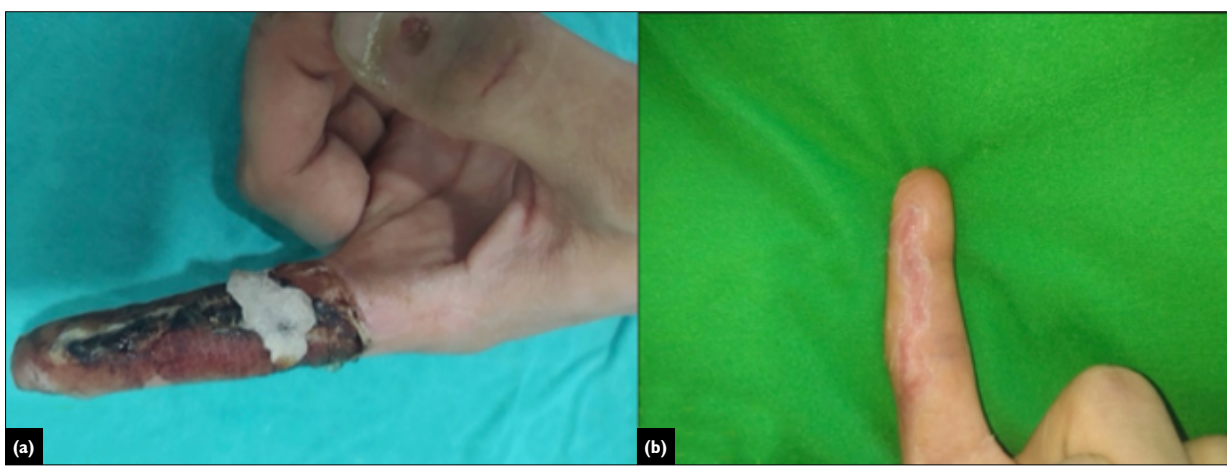

Figure 1. 44 Yo male, post traumatic tissue loss, before amniotic membrane use **(a)**, epithelized tissue after 2 weeks **(b)**.

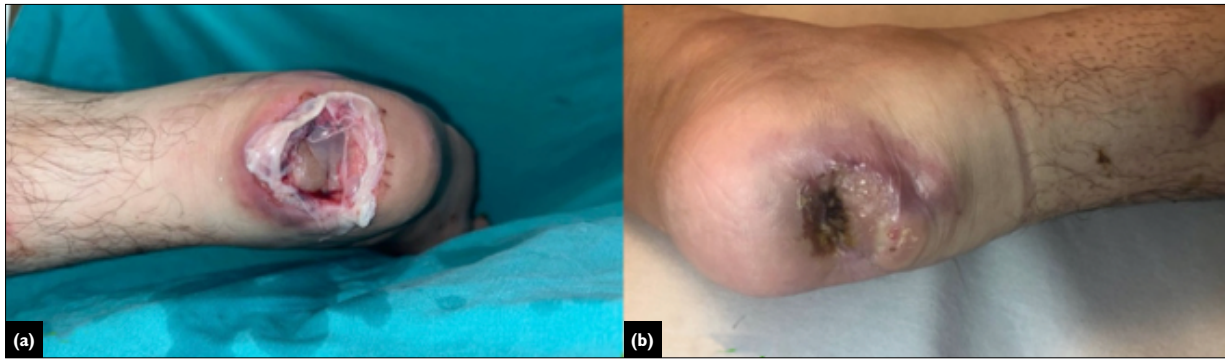

Figure 3. 18 Yo female, application of amniotic membrane to bone-exposed tissue at calcaneal region **(a)**, two weeks after application **(b)**.

the antibiogram. The bacterial tissue cultures revealed no growth. After surgical debridement, a human amniotic allograft was applied under sterile conditions to the viable tissue. A second amniotic allograft application was performed one week after the initial application. Following the procedure, the dressings over the amniotic allograft were changed every other day. No allergic reactions were noted during follow-up. Two weeks later, the area with the defect had reduced to approximately 8x4 cm, and the base appeared granulated. Reconstruction was performed under spinal anesthesia using a split-thickness skin graft harvested from the anterolateral thigh of the same side (Fig. 2).

Case 3

An 18-year-old female patient was followed up with a tissue defect of approximately 4x4 cm in the posterior calcaneal region of the right foot, exposing the calcaneus after trauma. Bacterial tissue culture obtained before the procedure showed no growth. Necrotic tissues in the defect area were surgically debrided, and no additional calcaneus debridement was performed. After debridement, human amniotic allograft was applied under sterile conditions to the viable tissues. Following the procedure, dressings over the amniotic allograft were changed every other day. No allergic reactions were noted during follow-up. Two weeks later, the defect base appeared granulated, and reconstruction was performed under spinal anesthesia using a split-thickness skin graft harvested from the anterolateral thigh of the same side (Fig. 3).

Other Cases

The remaining four cases generally consisted of middle-aged and elderly individuals, most of whom had comorbidities as indicated in Table 1. The procedure applied to these patients was similar to that described for the other cases: After debridement and the exposure of healthy tissue, the treatments were administered and followed up in a similar manner. Clinically, reductions in wound sizes were observed. Among these three cases, two presented with bone-exposed tissue defects; following membrane applications, a granulated wound bed was achieved. Although the patients eventually required surgery, the necessary procedures were less complicated due to the improved wound condition.

DISCUSSION

The application of amniotic membrane therapy in chronic wound management has evolved significantly since its first documented uses in the early 20th century. This technique, originally applied in ocular trauma and infections, has gradually expanded to other fields, including chronic wound care, where its immunomodulatory and regenerative properties have garnered attention.[1,10] Our study contributes to this growing field by examining the efficacy of amniotic membranes in challenging chronic wounds, focusing on the ability of this treatment to promote healing and reduce the need for complex surgical interventions. Numerous studies have highlighted the benefits of amniotic membrane therapy, particularly in diabetic and venous

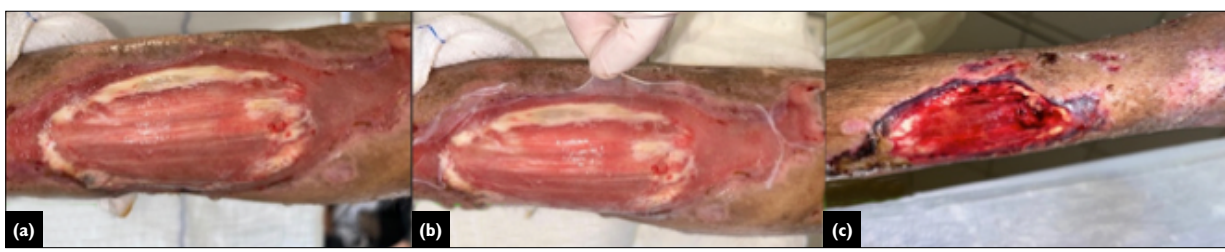

Figure 2. 65 Yo female with crural tissue loss which complicated with diabetes mellitus **(a)**, after surgical debridment and amniotic membrane use **(b)**, postoperative second week **(c)**.

ulcers. For instance, Zelen et al.[11] demonstrated in a 2013 randomized trial that amniotic membranes achieved a greater reduction in wound size than standard care in diabetic foot ulcers. A 2024 meta-analysis by Alomairi et al.[12] confirmed the efficacy of this approach in chronic venous and diabetic ulcers, underscoring its potential to accelerate wound healing. Our findings align with this literature, particularly regarding cases where the membrane was used before reconstruction to prepare the wound bed, which resulted in reduced surgical complexity. Unlike previous studies that primarily focused on wound closure rates, our research examined the broader implications of using amniotic membrane, including its effect on surgical outcomes. Among our cases, the patients with comorbidities presented significant challenges to traditional treatment modalities. Despite these complexities, the amniotic membrane contributed to granulation and epithelialization, reducing the necessity for advanced reconstructive procedures. Amniotic membranes, with their unique composition of extracellular matrix components, growth factors, and stem cells, provide a robust platform for tissue regeneration. These properties facilitate a moist wound environment, promote epithelialization, and suppress inflammatory responses, which establishes the membrane as a promising tool in chronic wound management. For instance, in trauma cases that do not include additional systemic conditions, using the membrane allows for simpler surgeries, such as skin grafts, which represent a transition from more invasive approaches. This finding highlights the potential for using amniotic membrane to bridge the gap between conservative and surgical management. However, although the outcomes of our study were encouraging, several limitations warrant discussion. First, the small sample size, including seven patients, restricts the ability of our findings to be generalized. Furthermore, the absence of a control group treated with standard care, or other advanced therapies limits direct comparisons. Future studies incorporating larger sample sizes and randomized controlled designs would provide more definitive conclusions. In addition, the variability in the types of amniotic membranes used—lyophilized versus cryopreserved—could influence outcomes, and this warrants further exploration. Also, while amniotic membranes offer significant therapeutic potential, their cost remains a critical factor in clinical decision-making. Effective patient selection is essential to ensure the balance between cost and benefit. Given that chronic wound care often incurs substantial healthcare expenditures, the ability of amniotic membranes to reduce hospital stays and surgical complexity represents a valuable contribution. However, long-term cost-benefit analyses are needed to validate these advantages in diverse healthcare settings.

Our study underscores the versatility of amniotic membrane therapy in managing chronic wounds, particularly in preparing complex wound beds for less invasive surgeries. While the benefits of this therapy are well documented in specific wound types, our findings suggest their potential in broader applications, even in cases with significant comorbidities. Future research should aim to standardize protocols and explore synergistic effects with other advanced therapies to maximize the potential of this innovative approach in wound care.

Informed Consent

Retrospective study.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: G.F., Ç.Ç.; Design: G.F.; Supervision: G.F., Ç.Ç.; Fundings: G.F., Ç.Ç.; Materials: S.O.A., E.A.; Data: S.O.A., E.A.; Analysis: G.F., Ç.Ç.; Literature search: G.F., Ç.Ç.; Writing: S.O.A., E.A.; Critical revision: S.O.A., G.F., Ç.Ç.

Conflict of Interest

None declared.

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Kronik Yaralarda Amniyotik Membran Kullanımının Etkinliği

Bu çalışma, insan amniyotik membranının kronik yara bakımındaki etkinliğini incelemekte ve doku rejenerasyonunu destekleyici özellikleri ile cerrahi müdahale gereksinimini azaltmadaki potansiyel rolünü değerlendirmektedir. Diyabet ve vasküler hastalıklar gibi komorbid durumlarla sıklıkla ilişkilendirilen kronik yaralar, klinik yönetim açısından önemli zorluklar teşkil etmektedir. Ekstrasellüler matriks bileşenleri ve büyüme faktörleri bakımından zengin, damarsız bir biyolojik yapı olan insan amniyotik membranı, immünomodülatör ve rejeneratif özellikleri sayesinde umut verici bir tedavi seçeneği sunmaktadır. Çalışmada, bir yara bakım ünitesinde kronik yara nedeniyle insan amniyotik membranı ile tedavi edilen yedi hasta retrospektif olarak değerlendirildi. Tedavi uygulamaları bir ila iki haftalık aralıklarla gerçekleştirilmiş olup, sterilite kurallarına uygun uygulama ve düzenli takip süreçlerine özel önem verilmiştir. Elde edilen bulgular, yara boyutlarında anlamlı küçülme, granülasyon ve epitelizasyon süreçlerinde hızlanma ile karmaşık cerrahi gereksiniminde azalma olduğunu ortaya koymuştur. Özellikle eşlik eden sistemik hastalıkları bulunan hastalarda, daha basit rekonstrüktif cerrahi girişimlere olanak sağlayacak şekilde uygun yara yatağı hazırlığı sağlanmıştır. Olumlu klinik sonuçlara rağmen, çalışmanın sınırlı örneklem büyüklüğü ve kontrol grubunun bulunmaması gibi kısıtlılıkları dikkate değerdir. Bulgular mevcut literatür ile uyum göstermekte olup, insan amniyotik membranının kronik yara yönetiminde standart tedavi protokollerine entegre edilmesine yönelik daha geniş örneklemli ve kontrollü çalışmalara ihtiyaç olduğunu ortaya koymaktadır. Genel olarak, insan amniyotik membranı; konservatif ve cerrahi yaklaşımlar arasında bir köprü işlevi görebilecek, maliyet etkin ve yenilikçi bir tedavi alternatifi olarak öne çıkmaktadır.

Anahtar Sözcükler: İnsan amniyotik membran; kronik yara; yara tedavisi.