

Collagen-Based Grafts and Autologous Dura Replacement in Patients with Dura Abnormalities: A Retrospective Comparative Evaluation

Zahra Mannan Waheed¹, Saima Firdous², Fahad Rafiq Butt³,
Sana Afzal Khan¹, Chinonso Ndubuisi⁴, Abrar Hussain⁵

(1) Fellow Anesthesia, Shaukat Khanum Memorial Cancer Hospital and Research Center, Pakistan

(2) Department of Zoology, Kohat University of Science and Technology, Kohat, Pakistan (ORCID: 0009-0008-8150-1697)

(3) Locum Consultant, Shaukat Khanum Memorial Cancer Hospital and Research Center, Pakistan

(4) Department of Family Medicine, Humboldt Park Health, Chicago, USA (ORCID: 0000-0001-6793-7031)

(5) Department of Biological Sciences, International Islamic University, Islamabad, Pakistan

Corresponding author:

Fahad Rafiq Butt, Locum Consultant,
Shaukat Khanum Memorial Cancer Hospital and Research Center,
Pakistan

Email: fahadrafiq@skm.org.pk

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Abstract

Introduction: Accidental spinal anomalies of the spinal dura mater are the source of cerebrospinal fluid (CSF) leakage. Typically, dura abnormalities are identified in 3 percent of endoscopic lumbar discectomy cases.

Objective: The purpose of the current research was to evaluate the results of autologous dura replacement versus collagen-based grafts in individuals with dura deformities.

Methods: The Institute of Neurosurgery at Liaquat National Hospital Karachi undertook this randomized evaluation to identify the most effective therapy for dura mater defects. Employing non-probability random selection, 82 cases among both sexes were selected. Participants were divided randomly into two subgroups i.e. Group 1A received an autologous graft for dura restoration, whereas Group 2B received a semi-synthetic dura replacement. A skilled surgeon led a medical team of six people who completed the entire process.

Results: The operation duration for semi-synthetic collagen was significantly reduced. There was a 40 minute variation in total time spent by the two groups. Autologous grafts showed ideal tightness and better flexibility and fair workability on the other hand semi-synthetic collagen showed better tightness and workability and ideal flexibility. Postoperative hospital stays were seen to be 26 + 2.5 hours in Group 1A whereas they were 23 + 2.5 hours for Group B.

Conclusion: According to the aforementioned findings, an accessible, secure, and efficient substitution for an autologous graft for dura restoration in dura abnormalities is the use of a semi-synthetic collagen substitute.

Keywords: semi-synthetic collagen substitute, cerebrospinal fluid, dura abnormalities, autologous graft.

Background

Accidental spinal anomalies of the spinal dura mater are the source of cerebrospinal fluid (CSF) leakage [1]. As a result of sudden intracranial hypotension (SIH), patients with spontaneous CSF leakage frequently report with orthostatic headaches [2]. Dura abnormalities and a drop in CSF levels occur in around 20% of thoracic myelopathy individuals [3]. Typically, dura abnormalities were identified in 3 percent of endoscopic lumbar discectomy cases [3,4]. These flaws can result in adhesive arachnoiditis, headaches, post-operative diseases, adhesive CSF pseudocysts and cerebrospinal meningitis [5]. After neurosurgery operations, dural abnormalities must be sealed to block the flow of CSF and minimise the risk of perioperative disorders [6].

Due to factors such as coagulation-induced dura contraction or renounce, surgical resection of the dura (resection of meningiomas), or dural damage after trauma, main closure is extremely difficult in a number of surgical situations. As a result, the dural defect must be repaired using a replacement [7,8]. There are several dura alternatives on the market right now. Solely dura grafts formed of semi-synthetic collagen seem encouraging among all these dura replacements because they are designed to consistently present a physical barrier, contain non-toxic, biodegradability biological material with antimicrobial properties, and have been established in terms of effectiveness and insulative properties. They are also assumed to maintain a matrix for in growth and subsequent replacement by endogenous connective tissue [9,10].

Due to their nontoxicity, quick integration into native tissues, flexibility, strength, ease of suturing, and lack of immunological or inflamed responses, autologous grafts like galea-pericranium or fascia lata serve as the ideal framework for dural transplants [11,12]. However, employing such tissues for an autograft is rarely effective [13]. The benefits of autologous grafts are their low cost, fairly widespread access, and bio-compatibility with the patient [14]. The disadvantages involve patient requiring a second surgical incision, an extended recovery duration, an upsurge in operating theatre time required for further tissue collection, and higher patient pain [15].

The purpose of the current research was to evaluate the results of autologous dura replacement versus collagen-based grafts in individuals with dura deformities.

Material and Methods

The Institute of Neurosurgery at Liaquat National Hospital Karachi undertook this randomized evaluation to identify the most effective therapy for dura mater defects. Employing non-probability random selection, 82 cases among both sexes were selected. Participants over the age of 18 who needed a dura replacement during supratentorial surgical treatment were included. Expectant mothers, individuals having weak immune systems, all

spine damage instances, and untreated wounds were all eliminated. Following the hospital ethics panel's clearance, the research was performed. The participant's caregivers also provided signed consent permission.

Participants were divided randomly into two subgroups i.e. Group 1A received an autologous graft for dura restoration, whereas Group 2B received a semi-synthetic dura replacement. A skilled surgeon led a medical team of six people who completed the entire process. Following surgery and dural replacement by auto-graft or semi-synthetic grafts, CSF drainage and disease were detected. Following that, the participants experienced routine follow-up and examinations every 3 weeks for 6 months. One set of patients undergoing supratentorial brain surgery received an autologous dura transplant.

At the intersection of the top and central thirds of the upper leg, a 4 to 6 cm long incision was made to remove the fascia lata from the medial thigh. In the superficial area of the abdominal portion, a bone flap was transplanted. All participants underwent preoperative medication, and surgical drains inserted surgically were eliminated two days following the surgery. Semi-synthetic dura grafts in the dimensions of 3.5x3.5 cm, 4x4 cm, and 6.5 cm x 6.5 cm were employed in the group 2B.

In order to do the statistical study, SPSS version 21 was used. The two subgroups underwent a Student's t-test to compare variables, and the results were deemed statistically meaningful at p value greater than 0.05.

Results

Eighty-two individuals with an average age of 38.46 ± 6.4 years were included in this retrospective comparative evaluation. Group 1A (autologous graft) and Group 2B of patients were randomly assigned to each category (semisynthetic collagen). Group 1A's patients had an average age of 42 whereas group 2B's patients had an average age of 34. Participants in both groups were more likely to be men than women. Four women (9.76%) and 37 men (90.24%) made up Group 1A, whereas nine women (21.96%) and 32 men (70.04%) made up Group 2B (Figure 1).

The average surgical time in group 1A was significantly longer than in group 2B (170.02 ± 4.5 minutes vs. 120.12 ± 4.5 minutes), with a mean difference of 40 minutes. By adopting a semi-synthetic collagen graft rather than an autologous graft, considerable time might be saved, according to the time factor. However, both groups noted statistically significant variations in the length of the surgery (< 0.002) (Table 1).

Compared to semi-synthetic collagen (6%), autologous surgery took 19% longer to complete. In neither group was an infection case noted. Post treatment, all individuals had intensive care unit (ICU) monitoring and underwent anti-epileptic drugs (AEDs) and therapies for oedema. Autologous grafts displayed ideal tightness,

better flexibility, and fair workability, while semi-synthetic collagen displayed better tightness, workability, and ideal flexibility (Figure 2). In Group 1A, the post - operative hospital stay was seen to be 26 + 2.5 hours, whereas Group 2B was 23 + 2.5 hours. There was no discernible change in the number of days the patient stayed in the hospital (Figure 3).

Figure 1: Gender distribution of patients with mean age.

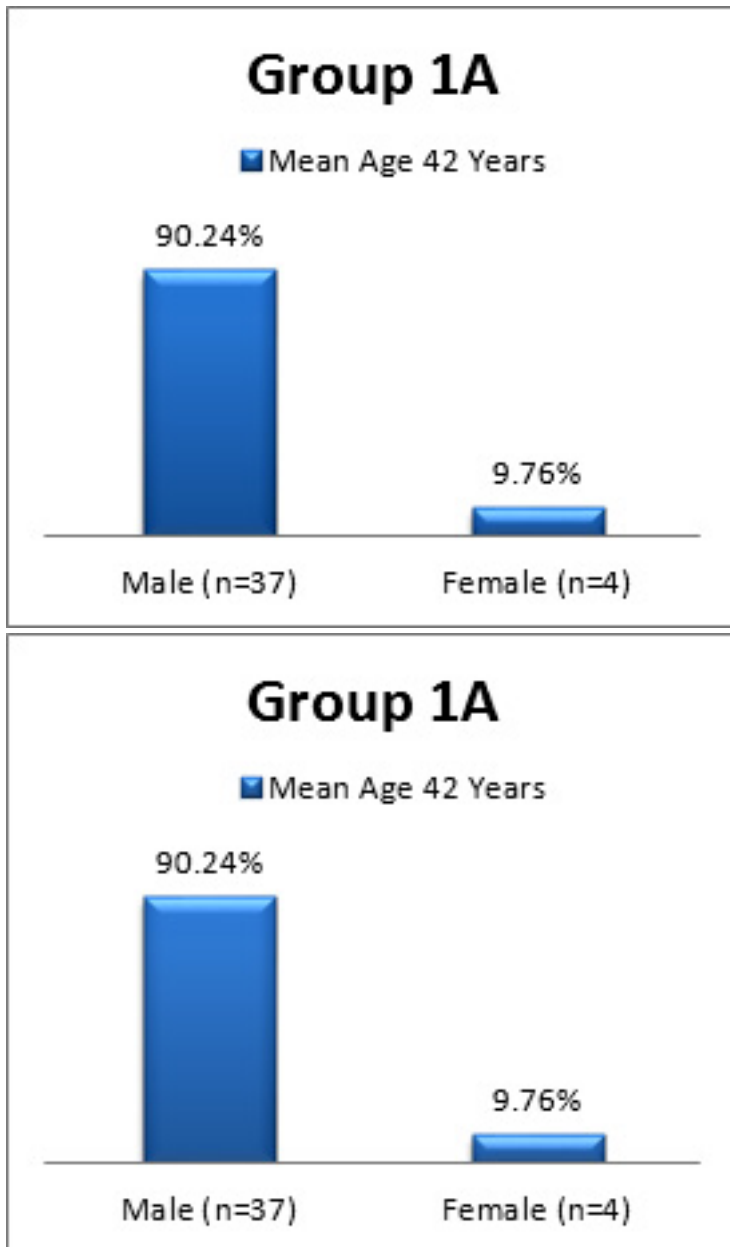
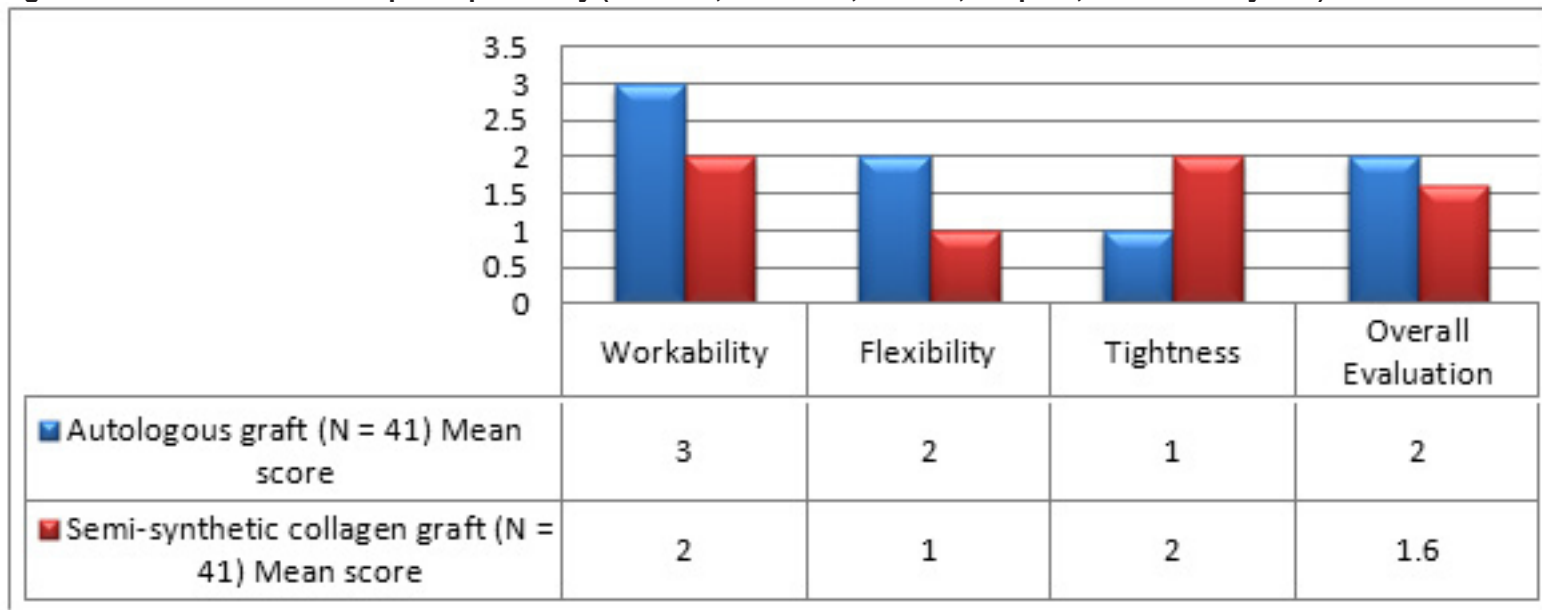
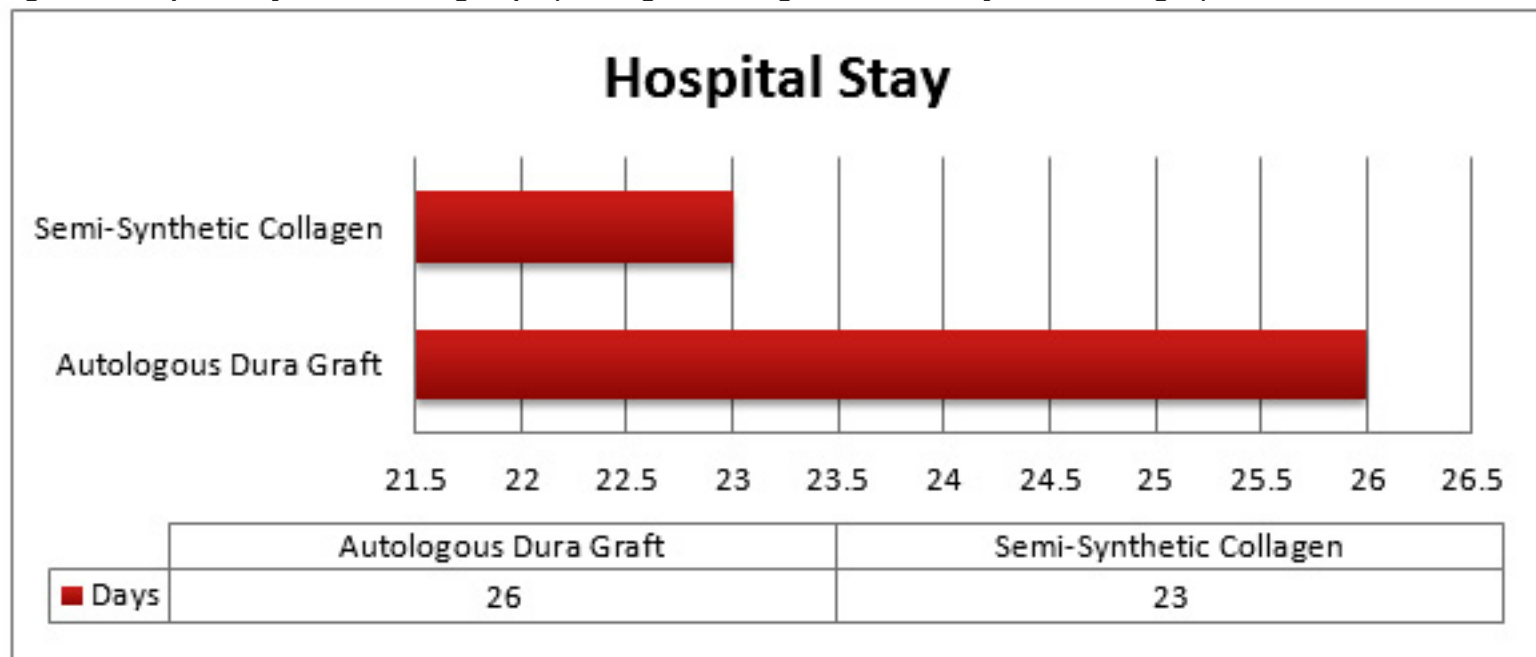


Table 1: Statistical evaluation of dura restoration

	Materials	Mean	Standard deviation	Typical Error of the Mean
Minutes spent doing the surgery	Autologous graft	170.02	3.53	0.78
	Semi-synthetic Collagen	120.12	4.53	1.02

Figure 2: Parameter evaluated post operatively (1 = Ideal, 2 = Better, 3 = Fair, 4 = poor, 5 = incredibly bad).**Figure 3: Hospital stay time of both groups (autologous dura graft and semi-synthetic collagen).**

Discussion

In current research, the effectiveness of autologous vs semisynthetic collagen-based grafts in individuals with dura mater defects was compared. The current research demonstrated that the operation duration for semi-synthetic collagen was significantly reduced. There was a 40 minute variation in total time spent by the two groups. These findings are consistent with the earlier investigation of Dash et al. [16]. Our autologous research group had CSF leaking as a result of the use of surgical dissection, prolonging the hospital stay. These findings are consistent with the earlier investigation of Ransom et al. [17].

In the current investigation, restorations were completed without the usage of stitches, and no CSF leaking was noticed throughout the follow-up period. According to studies, fixing dura abnormalities that cannot be fixed with standard reattachment techniques requires the use of autologous grafts as a quick and efficient strategy. Collagen matrix was shown to be a good method for anterior fossa in a research by Narotam et al. (18), during which it was used as a graft without employing stitches and causing any difficulty [18]. By attaching to the holes in the collagen matrix, the fibroblast acts as a framework for additional collagen. Collagen matrix is fully immersed and is replaced by a fresh dura mater at the end of seven weeks. Consequently, this method is simple to apply and has an effective safety record [19].

Autologous grafts showed ideal tightness and better flexibility and fair workability; on the other hand semi-synthetic collagen showed better tightness and workability and ideal flexibility. Additionally, postoperative hospital stays were seen to be 26 + 2.5 hours in Group A whereas they were 23 + 2.5 hours for Group B. Concerning the number of days the patient remains in the hospital, there wasn't any discernible difference. These results are consistent with research by Muhammad et al. [20].

Conclusion

Considering the aforementioned results, our research came to the conclusion that an easy, secure, and efficient replacement for an autologous graft for dura restoration in dura abnormalities is the use of a semi-synthetic collagen substitution. Comparing semi-synthetic collagen graft to autologous graft for dura restoration, there is a considerable reduction in operative time, surgical trauma, and the amount of time individuals remain hospitalized.

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