ORIGINAL ARTICLE

Use of Large Fascia Lata Graft as Dural Substitute in Neurosurgical Procedures at Neurosurgery Department Teaching Hospital D G Khan

IQBAL AHMAD KHARAL,[1] ASIM BHATTI,[2] SAMIA SAEED,[1] *Sajjad Ahmad*[1]
Department of [1]Neurosurgery and [2]Surgery, Ghazi Khan Medical College and Teaching Hospital Dera Ghazi Khan

ABSTRACT

Introduction: *Allogeneic grafts and other synthetic materials are being successfully used in dural grafting procedures. However, autologous resources including temporoparietal fascia, pericranium, peritoneum, and fascia lata provide an alternate substitute.' The use of fascia lata is the source of choice especially when large tissue is needed.*

Materials and Methods: *We present 21 cases 24 (75%) male, 7 (25%) female patients (age between 10 to 60 years) in which fascia lata was used for dural substitute when there was inadequate regional tissue, such as pericranium or temporalis fascia to repair the dural defect from May 2014 to April 2015, were analyzed retrospectively. Operative indications included in gunshot wound &head trauma 14 patients (50%), tumor in eight (28.5%), cerebrospinal fluid fistula in four (14.5%), infection in two (7.0%). This was a retrospective study and ethical approval was obtained from institutional ethical board. Department of Neurosurgery treated twenty eight patients in which fascia lata was used for dural substitute when there was inadequate regional tissue, such as pericranium or temporalis fascia to repair the dural defect from May 2014 to April 2016.*

Results: *The grafts' dimensions were from 4 × 8 cm to 8 × 18 cm. Clinical and radiologic follow-up was performed up to year after surgery. There were very limited significant complications related to the fascia lata grafting (in terms of cerebrospinal fluid leakage, meningitis, and wound infection. Two patients presented post-operative CSF leakage and were treated by percutaneous lumbar drainage. All patients improved completely, requiring no additional treatment. In few cases infection was either systemic or local, but required long-term and broad-spectrum antibiotic regimen.*

Conclusion: *Fascia lata is relatively simple and effective dural substitute for larger defects without any significant complications in our patients.*

Key Words: *CSF Fistula, Dural Repair.*

INTRODUCTION

The brain is protected mechanically by the meninges: Dura, arachnoid and Pia mater. The dura is the outer layer to be encountered after bone flap removal in craniotomy surgeries. The dura mater (literally, "tough mother") is the dense, leather like membrane covering and protecting the brain and spinal cord. Microscopically the outer layer of the dura is composed of fibroblast and collagen. The inner most layer is formed by flattened cells with sinuous processes.[1] The studies revealed some important biologic function of the dura beside its protective function.[2,3] There are many ways the dura can become damaged, including severe head injury, tumor in growth (meningioma), or a surgeon's need to open the dura for access to the brain or spinal cord during invasive surgical procedures.

The dural closure is important to prevent subgaleal collection via CSF leak, and future infection. The dura

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can be closed by either primary closure or duraplasty. Dural graft substitutes are used when the opening in the dura is too large to be sutured together.[1]

Nowadays, many advances are made. Types for dural substitution materials include, Autograft (Pericranium and fascia lata), Allograft (pericardium, lyophilized dura), Xenografts (bovine or porcine pericardium) and synthetic materials (polytetrafluoro ethylene, polyester urethane). However, each material had advantages and drawbacks that may limit their usage.[5,6]

The lower limb is circumferentially encased and reinforced by the connective layers and septae, that is, the superficial and deep fascial system and the crural septae. The superficial fascial system has a thin single layer or multiple fascial layers anchored to the dermis and the deep fascia by a network of thin septae. The superficial fascia is adherent to the iliac crest and gluteal fascia in males and females, respectively, and tends to be prominent posteriorly.[7] The fascia lata or the deep fascia of the thigh includes the thigh from the superior margins of the bony pelvis to the knee joint. The fascia gives rise to three thickened intermuscular septa that define the thigh's compartments and through which it is anchored to the femur. The fascia is thickest laterally and proximally and thinnest at the medial thigh. Laterally, the fascia is thickened and forms a thick band, the iliotibial tract.

Apart from enveloping and anchoring the tensor fascia lata and the gluteus maximus muscles to insert at the lateral condyle of the tibia, the iliotibial tract is a firm structure and can be regarded as a ligament stretched between the ileum and the tibia. The fascia is thickened also distally around the knee joint, particularly around the iliotibial tract insertion, and is strengthened by transverse fibers originating from the lower parts of the vasti muscles.[8]

Dural substitutes are necessary to prevent CSF leaks and to allow openings in the dura to heal after surgery. Dural substitutes can be either biological – harvested from animals or human cadavers – or synthetic, and are applied as an onlay or suturable grafts. The main benefit of using a dural substitute lies in its similarity to the patient's dura and its ability to absorb and integrate itself onto the host tissue.

Neurosurgeons used autologous pericranium, which is easy to harvest and heals well. However, it can be thin and fragile to the extent that may require some reinforcement with sealant.[7,8] Usually the pericranium is too small to cover a large defect in the dura and harvesting fascia lata may have the benefit of convenience and are available for larger defects.

So, the aim of our study is to measure the safety and efficacy of fascia lata as dural substitute for duroplasty in term of complications related to the fascia lata grafting (including cerebrospinal fluid leakage, meningitis, and wound infection) and cost effectiveness in different neurosurgical procedures.

MATERIAL AND METHODS

This was a retrospective study and ethical approval was obtained from institutional ethical board. Department of Neurosurgery treated twenty eight patients in which fascia lata was used for dural substitute when there was inadequate regional tissue, such as pericranium or temporalis fascia to repair the dural defect from May 2014 to April 2016.

Inclusion Criteria

All the patients in which fascia lata was used for dural substitute when there was inadequate regional tissue, such as pericranium or temporalis fascia to repair the dural defect.

Exclusion Criteria

All the cases, in which dura was closed with primary suturing or by pericranium and temporalis muscle fascia were excluded from the study.

The parameters reviewed were: patient demographic data, diagnosis, comorbidities (diabetes mellitus, hypertension, dyslipidemia and smoking), location of pathology, type of surgery, grafts' dimensions and evidence of CSF leak, meningitis, and wound infection.

Following initial evaluation and immediate lifesaving procedures patients were transferred for neurosurgical management. Surgery was performed on patients with large cranial defects for gunshot, traumatic brain injury, brain tumour, intracranial infections or cerebrospinal fluid (CSF) fistulae.

Pre-operative X-rays skull, CT scans and MRI brain were performed according to indications. All patients were treated surgically.

Surgical Technique

After the primary surgery in cases with large gaps between the dural edges, duraplasty was performed using tensor fascia lata tissue. With the patient lying in a supine position, the thigh is flexed to a level that allows knee flexion of 90^0 while being supported from below with packed drapes. The leg is fixed to the table

Fig. 1: *Fascia Lata Grafting in Large Dural Defect; Case of Fire Arm Injury.*

at 15° adduction of the hip joint. In this position, the fascia tightens while the indentation of the lateral intermuscular septum skin becomes evident, thereby clarifying the donor-site territory.

After harvesting, the graft is draped with a wet dressing until used. The fascial defect is left unreconstructed, and the skin is closed in layers. A vacuum drain is left in place for 24 to 48 hr or until draining less than 25 to 30 cc. After that fascia lata graft is stitched with dural margins in water tight fashion and scalp is closed in two layers.

All patients received a standard medication protocol that included third-generation cephalosporins for 7 to 14 days post-operatively together with anti-edema, anticonvulsant and analgesic agents. In most cases, titanium mesh was used to repair cranial defects, whereas some cranial defects were corrected using methylmetacrylate with primary or secondary cranioplasty. Patients suffering neurological impairment following surgery underwent rehabilitation. Follow-up for all patients consisted of neurological examination including CT scans at 3-month intervals after discharge.

RESULTS

Sex Incidence

We present 28 cases (75%) 21 male, 25%) female patients.

Age Range

The age range between 10 – 60 years) in which fascia lata was used for dural substitute when there was inadequate regional tissue, such as pericranium or temporalis fascia to repair the dural.

Etiology

Operative indications included in gunshot wound and trauma 14 patients (50%), tumor in eight (28.5%), cerebrospinal fluid fistula in four (14.5%), infection in two (7.0%).

Graft Sign

The grafts' dimensions varied from 4 × 8 cm to 8 × 18cm. The mean follow-up period for all patients was 1 year (range: 3 months – 3 years).

Follow-up

Clinical and radiologic follow-up was performed up to 3 year after surgery.

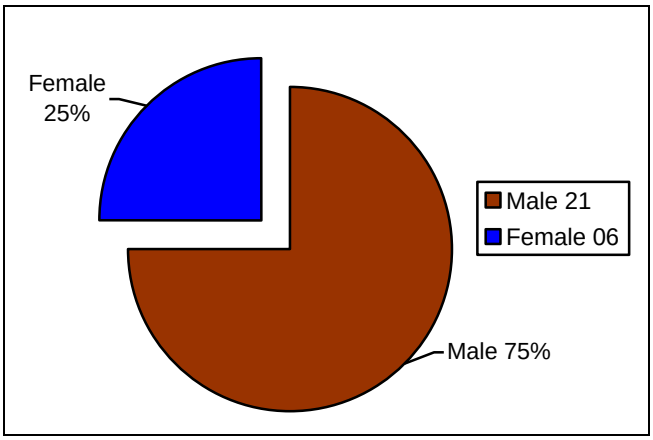

Fig. 2: *Gender Distribution.*

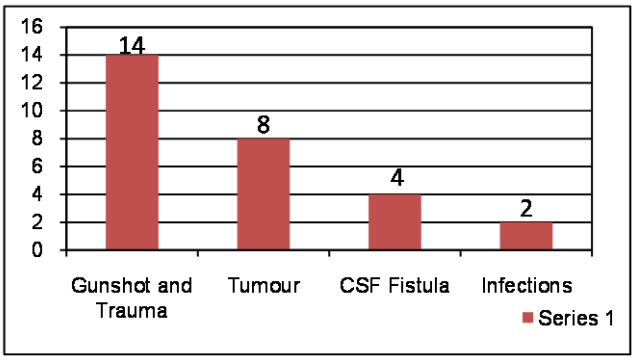

Fig. 3: *Types and No of pathologies (operative indications) included.*

Mortality

The mortality rate among the patients in this study was 10.6%, and the most common cause of death was gunshot and traumatic brain injury in 10% and pulmonary embolism in 5%.

All patients required extended hospital stays, mainly due to the length of post-operative rehabilitation.

Table 1: *Causes of Deaths.*

Causes of Death	No. of Patients
Gunshot Wound and Traumatic Brain Injury	(10%)
Pulmonary Embolism	(5%)

Complication

There were no significant complications related to the fascia lata grafting (in terms of cerebrospinal fluid leakage, meningitis, and wound infection).

The grafts' dimensions were from 4 × 8 cm to 8 × 18 cm. Clinical and radiologic follow-up was performed up to year after surgery. There were very limited significant complications related to the fascia lata grafting (in terms of cerebrospinal fluid leakage, meningitis, and wound infection. Two patients presented post-operative CSF leakage and were treated by percutaneous lumbar drainage. All patients improved completely, requiring no additional treatment. In few cases infection was either systemic or local, but required long-term and broad-spectrum antibiotic regimen.

DISCUSSION

Although there have been many studies for in dural grafting procedures, but there has been little analysis specifically at the large fascia lata graft as dural substitute in our institute. In this study, we have tried to present our experience of fascia lata graft as dural substitute in neurosurgery for various procedures.

Cerebrospinal fluid leakage is common complication after most types of neurosurgical procedures, provided that watertight dural closure sometimes is not achievable. Methods for repairing dural defects may involve direct primary suture, but frequently the gaps may not be easy for primary closure. The watertight primary closure of the dura sometimes cannot be achieved due to dural shrinkage secondary to dural dissection after a prolonged procedure.[13] The problem of CSF leakage whether it is collected under the scalp or dripping out of the skin is the high risk of developing an infection that can lead to serious morbidities and possible mortality. Different dural closure techniques have been used. Dural substitute development began in the 1890's with the use of gold foil or rubber, which proved unsatisfactory.[4] On the other hand, KRH von Wild in 1999, examined prospectively the safety and effi-

cacy of an absorbable dura mater substitute (Dura-Patch) on 101 patients, in normal applications in Neurosurgery. His results show the suitability of Dura-patch.[9] Whereas, when Malliti et al compares retrospectively the synthetic dural substitute (Neuro-Patch) (among 61 patients) and pericranium graft (in 63 patients) with regards to deep wound infection and CSF leak for one year. They reported the raised risk of complications with the synthetic (Neuro-Patch) graft as a foreign body.[10]

A recent monocentric prospective study from Italy is conducted by G. Sabatiro et al, which compared the galea pericranium dura plasty with non-autologous dural surrogates. The only difference was the cost, while the other clinical variables didn't show any significant statistical difference.[11]

Many reports have described the duraplasty method by each particular synthetic substitutes specially in cases like extensive meningioma resection (simpson 1 or 2)[4,10,11] or decompressive craniectomy.[12] But still the ideal substitute has not yet been well established.

In the current study we show that there is no significant CSF leak, this finding is different than what is reported in the literature before on a limited number of patients.[14-16]

Boudreaux, B et.al. advocate for the use of vascularized graft for repair of CSF leak in high risk patients, their recommendation is in line with our finding of using the pericranial flap that has better sealant effect.[19]

Different available materials for closure of the dura (such as, pericranium, dural adhesion barrier matrix or pericardial graft) seem to be similar with a little superiority to the pericranial flap. Huter et al. article showed that the CSF leak rate increased with diabetes, increased CRP and the need for dural patch. In the current study we show that there is no significant complication like CSF leak, meningitis and wound infection. The exact reason for these contradicting results is unclear; however, it may be related to the additional use of "tachosil" in Huter's study, different pathologies or immune compromise in diabetics that need a tight control, or possible presence of the infections as suggested by elevated CRP.[20]

A recent study shows that infratentorial surgery and > 8 days of postoperative corticosteroid were significant predictors for the development of CSF leak and wound infection. In our study, that is not the case with unclear reason, further studies are needed to explore this issue further.[21]

The use of reinforcing closure material (i.e. fat graft, fibrin sealant or cyanoacrylate glue) does not show any statistical difference regarding the superiority of one over the other except for the cost effectiveness.

Fibrin sealant is a natural extract, but the cost is sometimes a limiting factor. Finally, the **cyanoacrylate glue** is a synthetic material, cheaper than the **fibrin glue** but it can lead to inflammatory reaction, gliosis or meningeal irritation.[22,23]

We found that dural graft is cheaper and readily available for larger defects and second incision for harvesting the graft does not have significant effect on patient quality of life.

Limitation of Study

The limitations of our study are the retrospective design, limited number of patients, single center experience and different pathologies. So, we recommend conducting a prospective multicentric study with a larger number of patients and a unified type of pathology to limit the confounding variables in the study.

CONCLUSION

Fascia lata is relatively simple and readily available, cost effective dural substitute for larger defects without any significant complications in our patients, furthermore second incision for harvesting fascia lata do not have significant effect on patient quality of life.

Address for Correspondence:
Dr. Iqbal Ahmad Kharal
Assistant Professor and Head
Department of Neurosurgery
GKMC and Teaching Hospital, Dera Ghazi Khan
Cell No; 03320784851
Email:driqbalahmad33@gmail.com

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AUTHORS DATA

Name	Post	Institution	E-mail	Role of Authors
Dr. Iqbal Ahmad Kharal	Assistant Professor and Head, Department of Neurosurgery	Ghazi Khan Medical College and Teaching Hospital Dera Ghazi Khan	driqbalahmad33@gmail.com	Paper Writing
Dr. Asim Bhatti	Assistant Professor of Surgery			Literature Research
Dr. Samia Saeed	Consultant			Data Collection
Dr. Sajjad Ahmad	Consultant			Table & Graphs. Paper Reading

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