

ORIGINAL RESEARCH

A Comparative Study between Two Types of Materials Used for Duraplasty**¹Dr. Sanghamitra Sarkar, ²Dr. Shantanu Ghosh, ³Dr. Nilanjan Sinha**^{1,2}Associate Professor, Department of Neurosurgery, Calcutta National Medical College, Kolkata, West Bengal, India³Assistant Professor, Department of Haematology, Calcutta Medical College, Kolkata, West Bengal, India**Corresponding Author**

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Received: 15 June, 2023

Accepted: 10 September, 2023

Abstract

Background: Watertight dural closure is an essential part of all intracerebral operations in order to prevent CSF leakage and consequent infection and wound dehiscence which in turn cause delayed wound healing and this in turn increases patient morbidity and mortality. Various types of materials both autologous and synthetic have been used for duraplasty. This study compares the result and outcome between two types of synthetic materials commonly used for duraplasty.

Methods: This randomised prospective study was carried out in our hospital on 52 patients who underwent decompressive craniotomy. Patients were randomly divided into two groups. One group underwent duraplasty using a synthetic fabric patch graft, while the other group underwent duraplasty using collagen matrix graft and the results were compared between the two types of duraplasty.

Results: Patients who underwent duraplasty with collagen matrix graft were found to have a significantly reduced operating time of nearly 30 minutes as compared to those in whom synthetic fabric patch was used. Also there were no cases of CSF leakage or wound infection in patients who underwent duraplasty with collagen matrix.

Conclusions: Collagen matrix graft was found to be superior to synthetic fabric graft for duraplasty as not only does it save valuable operating time, it has fewer complications as compared to synthetic fabric grafts.

Keywords: Collagen matrix graft, Synthetic fabric patch graft, Duraplasty.

Introduction

Following any cranial surgery water tight dural closure is always desirable and is a very crucial step in any intracerebral surgery. In 1908 Cushing was the first to suggest that an accurate approximation of the dura in its two layers is desirable and should be painstakingly done.^[1]

Often primary dural closure may not be possible due to brain oedema or because a part of the dura was excised either because of a brain tumour involving the dura or when the dura is found to be lacerated in patients who undergo operations following head injury. Lax duraplasty is usually done in order to provide space for the brain oedema following decompressive craniotomy. At first duraplasty was done using autologous grafts like

pericranium, temporalis fascia or fascia lata. Autologous cervical fascia was also used for duraplasty.^[2]

The advantage of using Autologous grafts is that they are non toxic and since they are natural tissue they are rapidly integrated into natural tissue and do not have any inflammatory or immunological reaction. Also they have good strength, they are easy to handle and suture and are available for free.

However the disadvantages are that one has to operate at a different area from the primary operation and this results in an increase in operating time. The other disadvantages include donor site morbidity like infection, haematoma, delayed healing of donor site and postoperative pain.

This was the reason why efforts were made to search for alternatives to autologous grafts in the form of various synthetic materials to be used for duraplasty. Various materials have been tried like bovine graft, bilayered chitosan^[3] and later synthetic fabric grafts and collagen matrix grafts.^[4]

However some of these materials were found to induce a inflammatory host response^[5] and hence were subsequently discarded. In due course of time newer synthetic grafts like the fabric patch graft and later the collagen matrix grafts did not produce such reactions^[6] and hence are now being used increasingly being for duraplasty as compared to autologous grafts. The advantages of these synthetic grafts was that they reduced operating time, have a lesser incidence of CSF leakage, infection and wound dehiscence and there is no blood loss^[7] as compared to patients where autologous graft is harvested. However the disadvantage of these synthetic grafts is that they are costly, especially the collagen matrix grafts.

Some surgeons have however challenged the need for watertight closure of the dura^[8] and they have found the same incidence of complications in those who did not undergo water tight duraplasty as compared to those with water tight duraplasty.

Synthetic fabric patch grafts are made of polypropylene while collagen matrix graft is made of type 1 collagen which is taken from bovine Achilles tendon.

Methods

This randomised prospective study was done at the Neurosurgery Department of Calcutta National Medical College between 1st Jan 2018 to 31st December 2018 on patients admitted to our hospital.

60 patients who underwent supratentorial decompressive craniotomies for traumatic head injuries were included in the study. Patients with associated injuries like thoracic, abdominal or long bone fractures were excluded. Patients with diabetes mellitus were also excluded as it could be a confounding factor for wound healing.

These 60 patients were randomly assigned into either of the two groups. One group underwent duraplasty using synthetic fabric patch grafts while the other group underwent duraplasty using collagen matrix graft. Among these patients we lost 8 patients in the postoperative period and hence they were excluded from the study. The patients were kept admitted for an average period of 10 days postoperatively. After discharge patients were asked to come for follow-up after 10 days and subsequently at intervals of one month for a period of six months.

Data that was collected included the patients age, sex, how the accident occurred, Glasgow Coma Scale(GCS) at the time of admission and at the time of discharge. Operating time from incision to completion of skin closure was noted for each patient.

Postoperatively patients were observed for CSF leakage and wound infection and dehiscence. CT scan brain was done routinely 48 hours, 96 hours and 7 days after operation to look for any increase in brain swelling, mass effect and any subcutaneous CSF collection.

Results

The total number of patients in the study was 52 patients after applying inclusion and exclusion criteria. The findings of the study have been shown in the following tables.

Characteristics	Collagen Matrix Graft	Synthetic Patch Graft
Total Patients	26	26
Mean Age	32 Years	34 YRS
Male PTS	22 PTS	21 PTS
Female PTS	4 PTS	5 PTS
Mean GCS at Admission	8	9

Table 1. Characteristics of patients undergoing the two types of duraplasty

Road Traffic Accidents	40 PTS
Assault	7 PTS
Fall From Height	5 PTS

Table 2. Nature of Trauma

Collagen Matrix Graft	Synthetic Fabric Patch Graft
118 Minutes	160 Minutes

Table 3. Mean Operating Time

	Collagen Matrix Graft	Synthetic Fabric Graft
CSF Leak	0	5
Wound Infection	0	4
Wound Dehiscence	0	3
Subcutaneous CSF Accumulation	1	2

Table 4. Postoperative Complications

Glasgow Coma Scale	No. of Patients
15	12
13-14	33
9- 12	7
3-8	0

Table 5. GCS at Time of Discharge

As can be seen from the results, road traffic accidents are the most common cause of head injuries(77%) and among these cases male patients are most commonly affected (86%). Mean operating time was found to be significantly lower (average 32 minutes) in those patients who underwent duraplasty with collagen matrix graft as compared to those patients who underwent duraplasty with synthetic fabric patch.

Postoperative complications like CSF leakage, wound infection and wound dehiscence and subcutaneous CSF accumulation were also found to be significantly lower in those who underwent duraplasty with collagen matrix graft as compared to those who underwent duraplasty with synthetic fabric patch grafts.

Discussion

Water tight dural closure is the aim of all neurosurgeons, although some studies have questioned the need for water tight closure and have shown similar results and complication rates in patients who underwent water tight versus non water tight closure.

Initially autologous tissues like pericranium, fascia lata and temporalis fascia were used. These autologous tissues have numerous advantages, but they also have certain disadvantages like they require additional operative time to harvest the tissue and also there may be donor site morbidity. Hence autologous grafts have been replaced by synthetic grafts. Of the various synthetic grafts, synthetic fabric patch grafts were initially more widely used in our institute due to its easier availability and being significantly cheaper. Later collagen matrix grafts became available and have been increasingly used by us.

Synthetic fabric patch grafts need to be sutured to the dural margins while in the case of collagen matrix grafts they are just placed over the dural defect and they take up the contour of the dural defect, thus effectively sealing it. The graft is kept in place through surface tension and fibrin clot formation and hence there is no need to suture the margins of the graft to the dural margins.

In our study we found that traumatic head injuries were more commonly caused by road traffic accidents(80%) and were more common in male patients(86%). However the main outcome found in this study was that duraplasty using collagen matrix grafts required considerably less operating time (average 32 minutes) as compared to duraplasty using synthetic patch graft. Only one patient who underwent duraplasty with collagen matrix developed subcutaneous CSF accumulation which subsequently resolved within one month as confirmed by CT scan during his follow up at one month. There were significantly far more complications in patients who underwent duraplasty using fabric patch grafts. Five of these patients developed CSF leak out of which four developed wound infection and three patients had wound dehiscence which was managed with Acetazolamide. Two other patients had subcutaneous CSF accumulation which also resolved on conservative management. These complications increased the period of hospital stay by a considerable amount of time. Longer operating times have been found to be associated with an increased incidence of infection.^[9] This can greatly affect the outcome in already critical patients of head injury. A lesser incidence of complications helps in decreasing patient morbidity and mortality, which in turn reduces the duration of hospitalisation and this in turn helps to increase patient turnover in our hospitals which are always facing a crisis of beds.

The one and only disadvantage of collagen matrix grafts is that they are far more costly as compared to fabric patch grafts. However this is compensated for by savings in operating time. In addition lower incidence of complications and reduced hospital stay also help in significant saving of resources and also lesser morbidity and mortality.

Similar results have been found in other studies which compared temporalis fascia graft with collagen matrix grafts^[10] as well as other studies which used collagen matrix with various methods of fixation.^[11]

Conclusion

Duraplasty using collagen matrix grafts give far superior results as compared to fabric patch grafts, because not only do they reduce operating time significantly, they have a far lesser incidence of postoperative complications like CSF leakage, infection and wound dehiscence and hence help to reduce patient morbidity and mortality.

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