Fibrin Glue as an alternative to Microsuture Technique in brachial Plexus and peripheral nerve Injuries

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ABSTRACT

Objective: To compare the outcome of Fibrin glue with micro suture technique for the treatment of Brachial plexus and peripheral nerve injuries.

Methods: This randomized control trial was conducted at Military Hand Surgery Centre in Lahore Pakistan from July 2015 to December 2017. We managed 70 cases with brachial plexus and peripheral nerve injuries fulfilling the inclusion criteria in two groups. One repaired with fibrin glue(group A) and other with microsuture(group B) with follow up of one and half year. Outcomes were measured as convenience of the surgeon, duration of surgery and efficacy in the form of motor recovery. Post stratification Chi square test and independent sample t tests were applied to important variables taking *P* value of ≤ 0.05 as significant.

Results: A total of 70 patients were equally divided in two groups A and B (35 each).The mean age of group A patients were 34.37 ±8.23 and group B was 33.89 ±9.13.Brachial plexus injuries(BPI) were noted in 18(25.7%) patients in group A and 15(21.4%) patients in group B. Peripheral nerve injuries(PNI) were noted in 17(24.2%) patients in group A and 20(28.5%) patients in group B. The surgery was found convenient in Group A with Fibrin Glue repair where it was seen in 32 (91.42%) vs. 20 (57.14%) with p value of 0.02. Duration of repair was significantly high in Group B, with 6.34 ± 0.87 vs. 31.43 ± 8.31 minutes with p values of 0.0001 respectively. The efficacy was seen in 26 (74.28%) vs. 24 (68.57%) with p value 0.68.

Conclusion: Fibrin glue repair is a good alternative to micro suture technique in terms of convenience to surgeon and decrease duration for surgery. However, the efficacy was similar with no significant difference in grade of motor recovery in both groups.

Key words: Brachial plexus injuries, Fibrin glue, Nerve repair.

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INTRODUCTION

Nerve injuries are on a rise, in developing countries like Pakistan, due to rapid industrialization and increase in motor vehicle accidents and pose a great therapeutic challenge due to versatility in presentation and unpredictable prognosis. Hence brachial plexus (BPI) and peripheral nerve injuries (PNI) still remain the most difficult-to-treat type of injuries since the inception of recent nerve surgery era.[1]

The anatomy of the brachial plexus is complex and it is formed by the union of the ventral rami from C5 to T1 roots. Among the PNI, the brachial plexus is involved in 10-20% of the cases and in around 90% of the cases, motor bike accidents are the leading cause.[2] BPI can further be sub classified into upper trunk, extended upper trunk, lower trunk and swimming limb depending upon the roots of involvement. The best prognosis is seen in the injuries of upper trunk. The bad prognostic factors include

advanced age, high energy injury, significant soft tissue injury, pan plexus injury and pain lasting for more than six months.[3,4] Moreover, extra and intra-plexal nerve transfers are showing more promising results, recently, for both pre and post ganglionic BPI.

The injuries are detected on the basis of history, detailed clinical examination and the radiological investigation like compute tomography (CT) and Magnetic resonance imaging (MRI), along with nerve conduction studies (NCS). Sunderland classification system is one of the widely used classification systems to grade the injury in terms of choice of treatment and prognosis.[5,6] Surgical interventions are needed usually in Sunderland's grade IV and V injuries. The rationale includes to rule out nerve injury in every open wound; and can be managed conservatively in closed injuries unless definitely required, on the basis of NCS.

There are multiple modalities used, in the past, for the nerve coaptation; each carrying their own benefits and risks. The most widely used technique is micro suture repair technique but it is time consuming, more expertise is needed and surgeon convenience is another issue. In contrast, fibrin glue is recently being used for nerve repairs and is a quick, highly efficacious method and have shown comparable outcomes in recent times.[7,8]

Currently micro suture technique is used routinely to repair nerves in our institution. We hypothesized that fibrin glue was superior to conventional micro suture technique in terms of convenience to the surgeon, decrease duration of surgery and better efficacy in the form of motor recovery. The results of our study will help us in formulating standard guidelines for nerve repair in our institution.

METHODS

The aim of the study is to compare the efficacy of Fibrin glue with micro suture technique for the treatment of BPI and PNI. It was a randomized control trial conducted at a tertiary care Military Hand Surgery Centre in Lahore Pakistan from July 2015 to December 2017. A total of 70 patients of both genders with age more than 18 years were recruited by a non-probability consecutive sampling technique and distributed into group A and B through lottery method. Patients were incorporated in the study after approval of the Ethical Committee of the hospital and informed written consent on the consent form conceived for this study declaring the surgical procedure, likely complications and plan for post-operative follow up. In group A, nerve coaptation was achieved with fibrin glue and those in group B were managed with traditional epineural micro suture technique.

All BPI and PNI of upper limb cases with a history of trauma less than 1 year were included. These cases encompassed all primary end-to-end and graft repairs in case of PNI and nerve transfer cases in BPI, where coaptaion was involved to be acheived. However, cases with more than 1 year history of trauma, those not willing to get inducted in the research project due to various personal and technical reason including unwilling for follow up, nerve repair cases distal to wrist (motor and sensory nerves in palm and fingers) and those with associated musculoskeletal injuries with possible difficulty in post-operative rehabilitation were excluded. All the cases were performed at the same center by a single surgical team including 3 Consultant Hand Surgeons, who had experience of microsurgery for more than 7 years.

Coaptation in both groups is ensured under microscope. In group A, it was achieved with commercially available Human Fibrin Sealant which comes with fibrinogen and thrombin components packed in separate syringes with tips forming the common port. An 8-0 Polypropylene monofilament suture was used in epineural end to end microsuture nerve repair technique in group B. These cases were then followed up fortnightly for 3 months and then monthly for a year. The final outcome was seen at an average of one and half year. The outcomes were measured in the form of convenience of the surgeon, duration of nerve repair and efficacy in the form of motor recovery on the basis of Medical Research Council Grading System. Convenience of surgeon was measured with the help of post-operative questionnaire for a subjective assessment of level of difficulty experienced by the operating surgeon. A score of more than 6 points out of 10 was considered as a convenient surgery. Duration of repair is the amount of time surgeon spent under microscope during nerve coaptation. We used SPSS version 22 to analyze our data. Important quantitative variables were represented as mean±SD while qualitative as frequencies and percentages. Data presented in table where necessary. Post stratification Chi square test and independent sample t tests were applied taking *P* value of ≤ 0.05 as significant.

RESULTS

In this study, there were total 70 cases, 35 in each group A and B. There was even distribution of gender in both the groups with male dominance in both groups. Male patients in group A and group B were 31(88.5%) and 30(85.7%) respectively. Female patients in group A and group B were 4(11.4%) and

5(14.2%) respectively. A comparison of important study variables are shown in table I.

Two statistically significant findings were noted in our study. Firstly, fibrin glue(group A) was found to be more convenient to the operating surgeon than microsurgical suture(*P* value 0.02) and secondly the duration of surgery in group A patients(Fibrin glue) was found to be shorter than group B(*P* value 0.0001) as shown in table II.

Efficacy in the form of motor recovery on the basis of Medical Research Council Grading System showed that upto M3 recovery was noted in 15(57.69%) and 13(54.16%) patients in group A and B respectively. Recovery upto M4 was reported in 11 (42.31%) patients in both group A and B each. However the difference was not statistically significant(*P* value 0.90).No drop out was reported.

Table I: Comparison of study variables (n=70)

Study Variable	Group A (n= 35)	Group B (n= 35)	p value
Age	34.37 (SD 8.23)	33.89 (SD 9.13)	0.89
Duration of nerve injury (Weeks)	4.45 (SD 1.25)	5.11 (SD 1.89)	0.56
BPI	18	15	0.67
Other PNI	17	20	0.67

Table II. Outcome variables in both groups (n=70)

Outcome	Treatment group		p value
	Group A (n=35)	**Group B (n=35)**	
Convenience	32	20	**p= 0.02**
Duration of repair (Mins)	6.34 (SD 0.87)	31.43 (SD 8.31)	**p= 0.0001**
Efficacy In Total	26	24	p= 0.68
Grade of nerve recovery	**Group A (n=26)**	**Group B (n=24)**	
M3	15 (57.69%)	13 (54.16%)	p= 0.90
M4	11 (42.31%)	11 (45.84%)	p= 0.90

DISCUSSION

The peripheral nervous system is responsible for a number of voluntary and involuntary actions; and are also prone to injuries especially associated with bone and soft tissue trauma. The early and accurate surgical or medical management to conserve the prime nerve (Sensory or, most importantly, motor) function is the ultimate goal. The need for a cheaper, better and safer technique to repair these nerves is always needed and fibrin glue is showing its value in this context in recent research works.

Efficacy, in case of nerve repair in upper limb, refers to the grade of motor function recovered after a deliberate follow up. Surgical repair has been emphasized in all the instances whenever there are red flags. According to studies done regarding the nerve repair by surgical interventions the efficacy was seen in around two third cases treated with surgical repair. Moreover, the small injuries with lesser gap have shown good results by suturing technique and, in those cases with gap of more than three centimeters, the results have shown a slightly lower rate.[9,10] However, Konofaos[10] had shown that the better efficacy was seen in cases treated with tubulization in cases with nerve gap of more than three centimeters. According to a study by Grinsel and his colleague[11], they evaluated multiple modalities treated for nerve repair and it was seen that the efficacy was comparable in cases of both surgical micro suturing and fibrin glue. In the present study, the efficacy was comparable to previous studies but having no significant difference between types of nerve repair modalities(p=0.68). These findings were similar to the studies done in the past; though direct one to one studies were lacking and the parameters observed were also not the same.

Convenience in microsurgery is reflected by the quality and quantity of microsurgical repairs which a surgeon can perform with physical ease and technical perfection. Reduction in microsurgical procedure time reduces fatigue, making it convenient for surgeon and increases the patient flux through the operation rooms hence reducing the pre-operative long waiting lists. In the present study, the microsurgical nerve repair time was ominously less in the cases repaired with fibrin glue where it took mean 6.34 (SD 0.87) minutes as compared to 31.43 (SD 8.31) minutes taken in micro

suturing with p value of 0.0001 and this difference was also statistically significant in terms of convenience to the surgeon with p value of 0.02. Bhandari and his collegues [12] compared these two modalities and it was seen that fibrin glue reduced the surgical time by 30% as compared to the surgical suturing and furthermore it did not reveal any significant side effects. However, there was no significant dissimilarity in terms of efficacy.

The other studies done on fibrin glue repair have also shown high efficacies and a systemic review comprising 14 studies, done on humans and animals, have shown that fibrin glue is not only equal but have also revealed good efficacy as compared to suture repair.[13] In another study by Tse[14] had shown that nerve glue had shown superior results in cases with immediate intervention through bony foramen for a pre-ganglionic BPI where suturing was not technically possible.

Our study had few limitation. Firstly, our sample size was small, Secondly, we could not compare individual nerve repair results, primary end-to-end repair, graft repairs, nerve transfer and aetiology. Thirdly, we could not registered our trial with a registering data base. We therefore recommend further studies on this topic to address all such limitation.

CONCLUSION

Fibrin glue repair is slightly better and a good alternative to micro suture technique and this difference is statistically significant in terms of convenience to the surgeon and time taken for surgery. However, the efficacy was similar with no significant difference in grade of motor recovery in both groups.

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