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A study on vertical and oblique incision for hamstring graft harvest and its relationship with peri-incisional dysesthesia

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Abstract
Background: The incidence of Infra Patellar Branch of Saphenous Nerve (IPBSN) ranges from 12 to 84%. Hamstring harvest performed using vertical incision results in IPBSN injury more commonly than oblique incision.
Aim: To assess and compare the prevalence of infra patellar branch of saphenous nerve injury with vertical and oblique incision during hamstring graft harvest.
Methodology: This was an observational analytical study, which was conducted over a period of time from January to December 2017 at the Mahatma Gandhi Medical College and Research Institute Hospital. Patients with isolated ACL injury with or withoutt meniscal injury fulfilling the inclusion and exclusion criteria were the study participants. After obtaining necessary permissions and consent, the patients were divided into two groups (vertical and oblique incision group) for Hamstring graft harvest. Data on socio-demographic characteristics, surgery details and outcomes were obtained. The sensitivity and functional outcome were assessed at 1st 3rd & 6th month by using Highet's scale and Tegner Lysholm score respectively. The data obtained were entered into excel and analysed using SPSS v16.
Results: A total of 60 patients (30 in each group) participated and in our study. On comparing dysesthesia using Highet's scale in both the groups, oblique incision had 13% dysesthesia and vertical incision had 36% dyesthesia which was statistically significant with a p value of 0.037. The functional outcome which was assessed by Lysholm score in both vertical and oblique incision groups did not show any statistical difference
Conclusion: Infra patellar branch of saphenous nerve injury was assessed using Highet's scale in hamstring graft harvest and we found that oblique incision had a lesser incidence of injury compared to vertical incision and this was statistically significant. However there was no difference in the functional outcome in both the groups.

Keywords: Infra patellar branch of saphenous nerve, hamstring harvest, highet's scale, tegner

Introduction
ACL injuries will mostly occur in association with the meniscus injury, which will lead to early osteoarthritis of knee if unnoticed. [1]Arthroscopic reconstruction has become the gold standard treatment for ACL injuries. [2] Among the different grafts used for ACL reconstruction, autologous hamstring grafts have become successful because of its simplicity in harvest and graft management. Although autologous hamstring seems ideal graft to our context, it is not free from complexities. Sensory innervation for the medial part of knee joint, ankle, and leg are afforded by the saphenous nerve. Infrapatellar branch of the saphenous nerve (IPBSN) proceeds to anterior and is divided into inferior and superior branches for innervation of the anteromedial part of the knee. An incision over pes anserine tendons causes risk for IPBSN injury. [3] The injury of IPBSN has been connected to the vertical incision, which runs perpendicular to the course of the nerve. In an anatomical study, the difference in the anatomy of IPBSN was found, and the oblique incision was suggested over vertical incision for hamstring graft harvest, as the oblique incision is parallel to the course of IPBSN and thus there is less possibility of injuring the nerve. [4-16] we hypothesized that the incisions giving respect to the anatomy of IPBSN may ensure a lower complication rate. This study aims to

Compare the incidence of IPBSN injury between vertical and oblique incision.

Materials and Methods

This was an observational analytical study, which was conducted over a period of time from January 2017 to March 2018 at a tertiary care hospital in Pondicherry which was approved by The Institutional human ethics committee. Patients with ACL injury fulfilling the inclusion and exclusion criteria were included in the study. Our inclusion criteria were patient presenting with isolated ACL injury with or without meniscal injury, age above 15 years and patients where hamstring graft was the graft of choice. Patients with neurovascular injury in the same limb, patients with ipsilateral fracture in the same limb or patients with multi ligamentous injury were excluded from the study.

60 patients with ACL deficient knee were selected and verified and 30 patients in each group were randomly assigned to undergo hamstring graft harvest using vertical and oblique incision respectively. Consent was obtained from those who fulfilled the inclusion and exclusion criteria. The timing of surgery was decided by the surgeon in-charge depending upon the soft tissue and skin condition. Patients were reviewed at 1 month, 3 months and 6 months post operatively and were clinically evaluated. Loss of sensation was assessed using Height's scale and knee function was assessed using Tegner Lysholm score. Statistical analysis was done using SPSS version 21.0. Descriptive data was represented in frequency and percentage. Categorical variables were compared using Pearson chi-square test. Difference between continuous variables was performed using One-way ANOVA. Statistical significance was considered when p-value <0.05.

Results

Table 1: Distribution of Age of study patients

Age group	Frequency	Percentage
<20	5	8.4%
21-30	32	53.3%
31-40	17	28.3%
41-50	6	10.0%
Total	60	100.0%

Most of the patients were in 21 to 30 years age group followed by 31 to 40 years. Average age of the study population was 28.96 ±7.81 years. (Table 1)

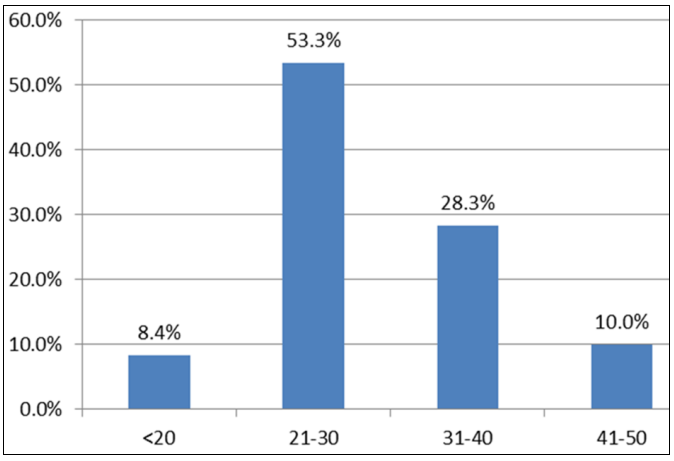

Fig 1: Distribution of age of the study patients

Table 2: Distribution of gender of the study patients

Gender	Frequency	Percentage
Male	53	88.3%
Female	7	11.7%
Total	60	100.0%

88.3% of patients were male and 11.7% were female in this study group. (Table 2)

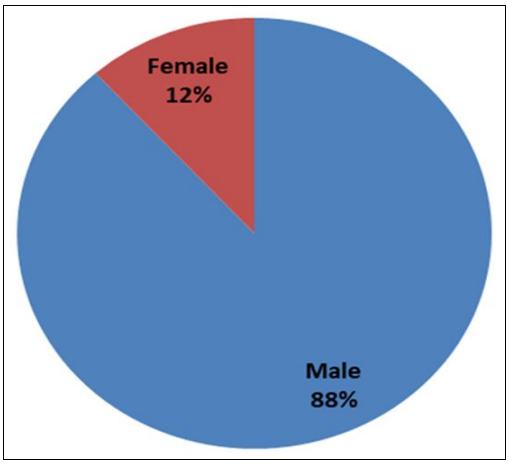

Fig 2: Distribution of gender of study patients

Operated side of the patients

Table 3: Distribution of side of the study patients

Side	Frequency	Percentage
Right	36	60.0%
Left	24	40.0%
Total	60	100.0%

In this study, right knee was commonly injured 36 (60%). Injury of the left knee constituted 24 (40%). (Table 3)

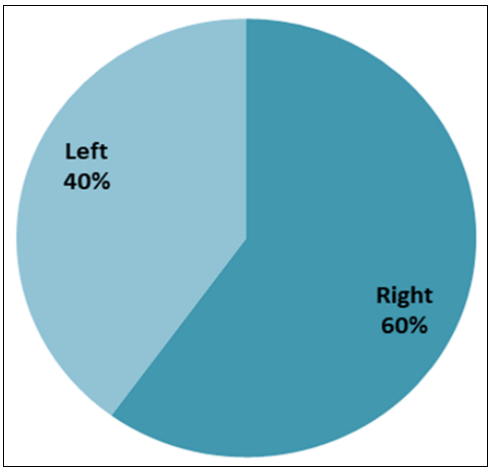

Fig 3: Distribution of side of study patients

Table 4: Oblique Incision: Cross tabulation of Highet's scale at 1st month and 6th month postoperative period

Highet's scale 1st month	Highet's scale 6th month		Total	P value
	S3+	S4		
S2	4	0	4	<0.0001
S3	2	11	13	
S3+	0	11	11	
S4	0	2	2	
Total	6	24	30	

In Oblique incision group, on comparing 1st month postoperative Highet's scale with 6th month Highet's scale results demonstrated that sensation recovered with statistical significance. (P<0.0001)

According to Highet's scale at 1st month four patients had S2 sensation and all those four patients improved to S3+ sensation at 6th month postoperatively. 13 patients had S3 sensation at 1st month post operatively out of which 11 patients improved to S4 at 6th month of follow up and two patients improved to S3+. 11 patients had S3+ sensation at 1st month post operatively out of which all 11 patients improved to S4 at 6th month of follow up.

Two patients had S4 sensation at 1st month post operatively which shows that patient did not experience any nerve damage during the procedure.

Table 5: Vertical Incision: Cross tabulation of Highet's scale at 1st month and 6th month postoperative period

Highet's scale at 1st month	Highet's scale at 6th month				Total	P value
	S2	S3	S3+	S4		
S1	1	4	0	0	5	<0.0001
S2	0	3	3	0	6	
S3	0	0	6	8	14	
S3+	0	0	0	5	5	
Total	1	7	9	13	30	

In vertical incision group, on comparing 1st month postoperative Highet's scale with 6th month Highet's scale results shown, sensation recovered with statistical significance. (P<0.0001).

According to Highet's scale at 1st month five patients had S1 sensation out of which four patients improved to S3 sensation and one patient improve to S2 at 6th month follow up. 6 patients had S2 sensation at 1st month post operatively out of which three patients improved to S3 and three patients improved to S3+ sensation at 6th month of follow up. 14 patients had S3 sensation at 1st month post operatively out of which 6 patients improved to S3+ and eight patients improved to S4 at 6th month of follow up. Five patients had S3+ sensation at 1st month postoperatively and all patients improved to S4 sensation at 6th month follow up.

Table 6: Cross tabulation of incisions with dysesthesia

Incision	Dysesthesia		P value
	No	Yes	
Oblique	26	4	0.037
Vertical	19	11	

On comparing dysesthesia in both the groups, oblique incision had 13% dysesthesia and vertical incision had 36% dysesthesia which was statistically significant with a p value of 0.037.

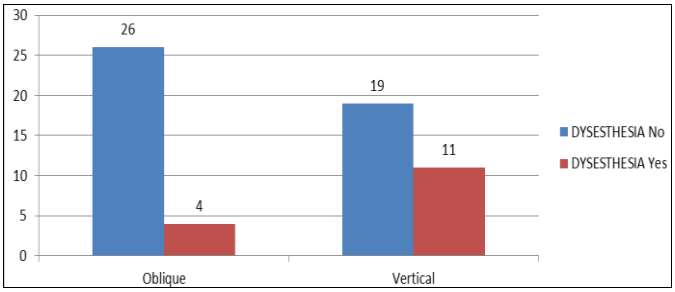

Fig 4: Cross tabulation of incisions with Dysesthesia

Assessment of functional outcome using Tegner Lysholm score

Table 7: Cross tabulation of Incisions with Lysholm Score at 1stmonth postoperative period

Incision		Mean	Std. Deviation	P value
Lysholm Score at 1st month	Oblique	56.67	5.30	0.492
	Vertical	55.70	5.52	

Comparing 1st month post-operative Lysholm score of Oblique and vertical incision, it showed no statistical significance. (P=0.492) Both groups showed poor outcome and the score remained less than 65.

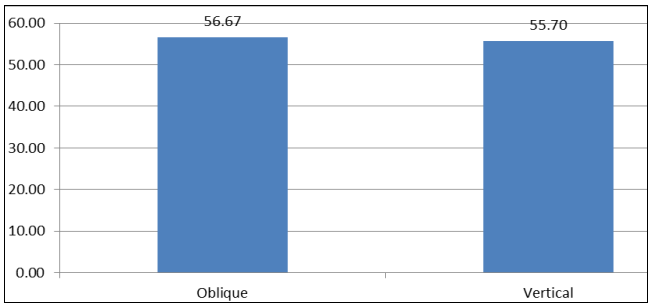

Fig 5: Mean value of both incision groups Lysholm Score at 1st month follow up

Table 8: Cross tabulation of Incisions with Lysholm Score at 6th month postoperative

Incision		Mean	Std. Deviation	P value
Lysholm Score at 6th month	Oblique	91.83	3.21	0.248
	Vertical	92.70	2.51	

Comparing 6 months post-operative Lysholm score of Oblique and vertical incision showed no statistical significance. (P=0.248) Both groups showed excellent outcome in Lysholm score in 6 months of post-operative period. (Score >90).

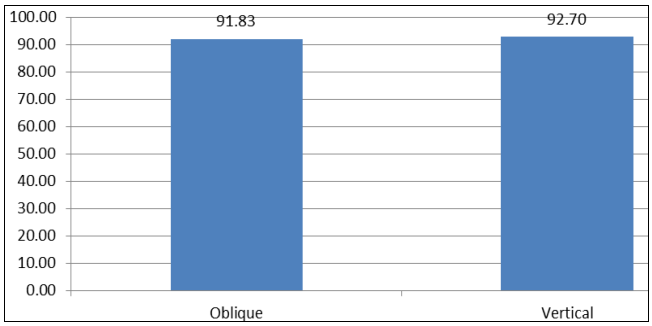

Fig 6: Cross tabulation of Incisions with Lysholm Score at 6 months postoperative

Discussion

In our study group most of the patients were in 21 to 30 years age group followed by 31 to 40 years and average age of the study population was 28.96 ±7.81 years. Similarly in the study done by Sipahioglu S *et al*. the average age of the study population was 31.1 ±7.7years [7].

In our study 88.3% of patients were male and 11.7% were females. Similarly in study done by Joshi A *et al*. male patients were predominant (91%) [8].

Kjeagaard *et al*. in his study found that hypoesthesia is a

common complication (88%) after hamstring ACL surgery. Change from vertical to slightly oblique incision did not reduce the morbidity. Furthermore, the area with sensory loss, felt by the patient shortly after surgery, was shown to decrease significantly by 46.3 percent after one year. [9]

In study conducted by Leite ML *et al*. showed that the total rate of dysesthesia was 42% (14 patients). Five patients (26%) on the oblique incision group and nine patients (64%) on vertical incision group reported dysesthesia symptoms. [10]

Similarly in our study, normal sensitivity in the oblique incision group improved from 6% at the end of one month postoperative period to 80% at the end of six months postoperative period. Whereas, normal sensitivity in the vertical incision group improved from 0% at one month follow up to 43% at the end of six months. This proves that patient under oblique incision group have a better outcome after surgery and recover from dysesthesia.

Portland *et al*. did a retrospective comparative study of ACL reconstruction, results showed that 20 patients (59%) with a vertical incision had evidence of damage to the IPBSN as opposed to 18 patients (43%) with a horizontal incision [11]. Similarly in our study 11 patients (36%) with vertical incision had evidence of damage to IPBSN whereas 4 patients (13%) in oblique incision group has nerve injury.

Sabat and Kumar *et al*. did a prospective comparative study of nerve injury during hamstring graft harvest using three different incisions injury to IPBSN was maximum with vertical incision with p value of 0.000. The incidence, area of hyperaesthesia and persistence nerve injury at 6 months were significantly higher with vertical incision group [12].

Joshi a *et al*. did a comparative study of infra patellar branch of saphenous nerve injury during hamstring graft harvest in vertical versus oblique Incisions. At final follow up Tegner Lysholm score and scale was recorded to compare between two groups. Results showed that the incidence of infrapatellar branch of saphenous nerve injury was 25% in vertical group and 16.36% in oblique group but there was no statistical difference in Lysholm score between both groups which was above 90 [8].

Tavakoli DR *et al*. did a study on comparing oblique and vertical incision during anterior cruciate ligament reconstruction using medial hamstring auto-grafts. The mean Lysholm and VAS scores were the same in the vertical and oblique groups. Also, the nerve injury did not affect the Lysholm score (89.9 ± 9.8 in patients without IPBSN injury versus 91.9 ± 8.5 in patients with IPBSN injury) [13].

Similarly in our study both groups showed excellent outcome in Lysholm score (more than 90) at 6th month of post-operative follow up but there was no statistical difference between both groups.

The limitations of the study were that it was done on a small group of patients. Also subjectivess limitation was noted in Highet's scale because dysesthesia was measured using digit pressure.

Case series

Cases in Oblique Incision Group

Fig 1: Oblique incision Case-1 **Fig 2:** Oblique incision Case-2

Fig 3: Oblique incision Case-3 **Fig 4:** Oblique incision Case-4

Fig 7: Oblique incision Case-1 **Fig 8:** Vertical incision Case-2

Fig 9: Vertical incision Case-3 **Fig 10:** Vertical incision Case-4

Conclusion

In our study infra patellar branch of saphenous nerve injury was assessed using Highet's scale in hamstring graft harvest and we found that oblique incision had a lesser incidence of injury compared to vertical incision and this was statistically significant. However there was no difference in the functional outcome in both the groups.

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