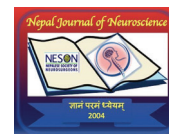


Outcome of Jensen Procedure for Complete Abducent Nerve Palsy in Tertiary Eye Hospital of Nepal



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Abstract

Introduction: Jensen procedure is done for correcting a large amount of esotropia and improving abduction in complete abducent nerve palsy. It is a modified form of transposition surgery where the superior, inferior, and lateral rectus muscles are split longitudinally and their lateral halves are respectively joined to the superior halves and inferior halves of the lateral rectus with non-absorbable sutures. The study was done to find the surgery outcome of the Jensen Procedure in complete abducent nerve palsy.

Methods and Materials: A retrospective study of complete abducent nerve palsy of greater than six months duration that underwent the Jensen Procedure was performed. Preoperative deviation and postoperative deviation at six weeks and three months were measured and analyzed. Clinical photography and diplopia charting of each case was done before surgery, and postoperatively at three months follow up in all cardinal gazes.

Results: Eight eyes of eight patients with a mean age of 38.50 ± 22.32 years (16 - 83) underwent medial rectus recession with muscle union (Jensen's) procedure. Three right eyes and five left eyes were operated. The preoperative esodeviation reduced from mean preoperative $74.37 \pm 28.21\Delta$ (30 - 120 Δ) base out to mean post-operative $12 \pm 12.29\Delta$ (-8 - 30 Δ) base out. The abduction deficit improved from mean preoperative -3.75 ± 0.46 (-4 to -3) to postoperative -1.87 ± 0.99 (-3 to 0). All cases were satisfied with their ocular alignment and cosmesis.

Conclusion: The Jensen Procedure can successfully correct a large amount of deviation due to complete abducent nerve palsy with improvement in functionality, abduction deficit, and cosmesis.

Key words: Esotropia, Diplopia, Jensen's procedure, Abducent nerve palsy

Introduction

Abducent nerve palsy is reported to be one of the most common isolated cranial nerve palsy.¹⁻³ The common etiologies are congenital, trauma, viral illness, stroke,

brain tumor, raised intracranial pressure and idiopathic.³⁻⁶ Patient with complete abducent nerve palsy presents with large angle esotropia necessitating improvement in abduction at primary gaze, thus many approaches has been introduced.⁷⁻⁹ This can be achieved for short duration by the use of Botulinum toxin, nevertheless long term results requires surgical intervention.¹⁰ Hummelsheim¹¹ and Jensen¹² procedure were first to gain popularity for its principles of transposition, but various modification^{13,14} has been made in recent years to these procedure to reduce the incidence of complications.⁷

Jensen's Procedure was first described by Jensen¹² and then by Selezinka et al¹⁵ as a modified form of transposition surgery where the superior rectus (SR), inferior rectus (IR), lateral rectus (LR) muscles are split longitudinally and their lateral halves are respectively joined to the superior halves and inferior halves of LR using non absorbable sutures as shown in Figure 1.¹² It was reported to result in better functional and cosmetic outcome^{15, 16} and shorten duration of procedure with less structural trauma.¹⁷

This study was conducted to find the surgical outcome of Jensen's procedure done for abducent nerve palsy in our center and to report the patient cosmetic satisfaction following the procedure.

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Methods and Materials

A retrospective study of all cases undergoing Jensen's procedure for complete abducent nerve palsy for a duration of greater than six months from 1st January 2017 to 30th April 2018 were included in the study. The study was approved by the ethical committee of Mechi Eye Hospital and it adhered to the tenets of the declaration of Helsinki.

All the patients included in study had pre-operative evaluation that included visual acuity, refraction, assessment of ocular motility and alignment, detail slit-lamp examination and fundus examination using 90D lens, detail orthoptic evaluation including prism cover test to measure the amount of deviation, diplopia charting and forced duction test to rule out MR fibrosis. Clinical photography in all cardinal gazes was done in all the cases as per institutional protocol. In addition, ductions were graded on a 9-point scale of -4 through to +4 where 0 represents normal full ocular motility, negative for underactions and positive for overactions.¹⁸ Reading was taken as follows: -4 = no movement of the eye(s) past midline (marked), -3 = 75% deficit of movement (moderate), -2 = 50% deficit of movement (small), -1 = 25% deficit of movement (slight), + values represent similar percentages of excess movement. Finally, MRI Brain and Orbit was done in all the cases planned for surgery to rule out LR atrophy.

All the cases underwent maximum MR recession with muscle union (Jensen's) procedure under local or general anesthesia. A 120 degree fornix based conjunctival peritomy was done in lateral limbus; LR, SR and IR were separately isolated. Each of the three muscles were split into two halves with special care to prevent anterior ciliary artery in the vertical recti muscles. Superior halves of LR and half of SR muscle belly and similarly inferior halves of LR and half of IR muscle belly were sutured with a non-absorbable 6-0 suture, 5-6 mm posterior to the muscle insertion and then a scleral fixation suture was applied. A conventional MR recession of 10 mm was done. Conjunctival peritomy was closed with 8-0 polyglactin.

Postoperatively, the amount of deviation was measured on the first day, six weeks, and 3 months after the surgery using the prism cover test. Diplopia charting, graded duction, and Clinical photography in all cardinal gazes were done 3 months after the surgery. Also, the Worth four dot test was used for accessing binocular single vision in the primary position at 3 months. In addition to this, the Cosmetic and Satisfaction Questionnaire for ocular alignment and cosmesis with a Likert scale (1 = very satisfied, 2 = somewhat satisfied, 3 = neither satisfied nor dissatisfied, 4 = somewhat dissatisfied, and 5 = very dissatisfied) was requested to be filled by all the patients as per the institutional protocol for strabismus surgery.

The data was finally analyzed using SPSS software version 23 with appropriate statistical tools.

Results

A total of eight cases, seven male and one female with a mean age of 32.14 ± 14.29 years (16 – 83 years) all operated by a single surgeon were included in the study. The mean duration of illness was 5.37 ± 6.26 years ranging from 6 months to 19 years with trauma being the commonest etiology. All the cases had unilateral presentations except one which had a bilateral presentation. The left eye was commonly involved among unilateral cases and 87.5% (7) of patients had abnormal head posture. All cases had diplopia at primary gaze and no cases had LR atrophy in MRI. The details of each case are shown in Table 1.

Pre-operative and three months post-operative deviation and duction is shown in Table 2. Preoperative deviation ranged from +30 to +120 prism dioptres (PD) in unilateral palsy and +90 PD in bilateral palsy with the mean of 74.37 ± 28.21 PD. Mean preoperative abduction deficit was -3.75 ± 0.46 (-4 to -3). Post-operatively the deviation and abduction deficit reduced to the mean of 12 ± 12.29 PD (-8 to +30 PD) and -1.87 ± 0.99 (-3 to 0). The mean adduction decreased from $+1.25 \pm 1.38$ (0 to +3) to -0.75 ± 1.16 (-2 to +1).

Among the eight patients operated on, one (patient no. 8) was orthophoric and three (patient no. 3, 6, 7) were esophoric, in which fusion and stereopsis were restored where there was no field of binocular single vision before surgery and hence had the binocular single vision with worth four dot test in primary position. Pre and post-operative photos of patient no. 6 are shown in Figure 2. Three (patients no. 1, 2, 5) had small residual esotropia while one (patient no. 4) had small consecutive exotropia. Abnormal head posture was improved in five patients (Patients no. 1, 2, 3, 6, 7) but diplopia persisted in two cases. No other complication was present.

The response to the Cosmetic and Satisfaction Questionnaire for ocular alignment and cosmesis is summarized in Table 3 with all the patients satisfied with their outcome except one, whose response was equivocal.

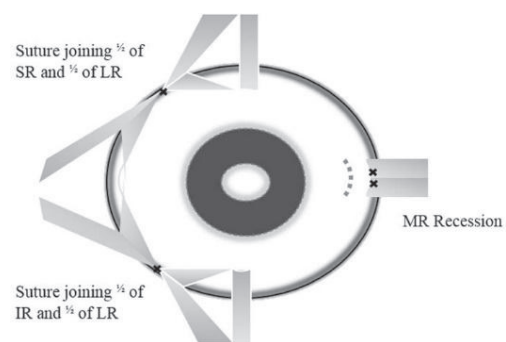


Figure 1: Schematic of Jensen's procedure. The operative eye in the figure is a right eye. (SR: Superior Rectus; IR: Inferior Rectus; MR: Medial Rectus; LR: Lateral Rectus)



Figure 2: Patient no. 6 showing before (A) 70 PD of esotropia preoperatively and (B) 5 PD of esophoria postoperatively

Table 1: Profiles of eight patients with abducent nerve palsy

Patient No.	Sex	Age (years)	Cause	Laterality	Duration (years)	Operated Eye
1	Male	29	Trauma	Both Eye	3	Right
2	Female	19	Idiopathic	Left Eye	19	Left
3	Male	28	Trauma	Left Eye	8	Left
4	Male	58	Trauma	Right Eye	8	Right
5	Male	33	Idiopathic	Left Eye	2	Left
6	Male	16	Trauma	Left Eye	1.5	Left
7	Male	42	Idiopathic	Right Eye	1	Right
8	Male	83	Trauma	Left Eye	0.5	Left

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Table 2: Preoperative and postoperative deviation and ductions (PD: Prism Dioptres, Abd: Abduction, Add: Adduction)

Patient No.	Operated Eye	Pre Op Dev (PD)	Pre Op Abd	Pre Op Add.	Pre Op Force Duction Test	Post Op			Diplopia
						Dev (PD)	Abd	Add	
1	Right	90	-4	3	Negative	20	-3	1	No
2	Left	120	-4	3	Positive	30	-2	-2	No
3	Left	95	-3	2	Positive	14	-2	0	No
4	Right	50	-4	0	Negative	-8	0	-2	Yes
5	Left	80	-3	0	Positive	20	-2	0	Yes
6	Left	70	-4	2	Positive	5	-2	0	No
7	Right	60	-4	0	Negative	15	-3	-2	No
8	Left	30	-4	0	Negative	0	-1	-1	No

Table 3: Cosmetic and satisfaction questionnaire with Likert scale

	Patient No.	Very satisfied	Somewhat Satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied
Rate your satisfaction for ocular alignment and cosmesis	1	1	②	3	4	5
	2	1	②	3	4	5
	3	①	2	3	4	5
	4	1	2	③	4	5
	5	1	②	3	4	5
	6	①	2	3	4	5
	7	①	2	3	4	5
	8	①	2	3	4	5

Discussion

Esotropia due to abducent nerve palsy often results in disfigurement and functional disability due to diplopia in the primary gaze.⁷⁻⁹ Although achieving orthophoric conditions for these cases is greatly challenging, Jensen's procedure is a relatively safe and effective procedure to reduce the amount of deviation, and restore cosmesis and functionality.^{15,16} In this study we have evaluated the outcome of the patient undergoing Jensen's procedure.

In our study, the mean preoperative deviation and mean postoperative deviation is comparable to that reported by Scott et al.¹⁹ Studies like Selezinka et al.¹⁵ and Frueh and Henderson¹⁶ that performed this procedure had comparably lower preoperative deviation. Hence their post-operative deviation was also low compared to our study. In our study, abduction deficit improved from -3.75 to -1.87 which corresponds to about 47 percent improvement in lateral motility, such improvement of over 25 percent is also reported in the comparing literature.^{16,12}

Jensen himself reported the average correction following the procedure to be 31 PD,¹² but the reported correction by Scott, Cline, Maruo, and Park & Oh is much higher.^{14,20,21,19} In this study, the average correction was

62.37 PD, which is comparable but still higher than the comparing literature.^{14,20,21,19} This might be due to the maximum MR recession we had conducted in all the patients undergoing surgery as the combination of the two procedures had resulted in a better outcome among those with a deviation more than 25 PD.¹⁶ The result we have managed to achieve is even high than those reported by Nishida et al.¹³ in which vertical rectus muscles were splitted into halves and were sutured to sclera without tenotomy of vertical rectus muscles, Murthy SR et al.²² where modified Nishida's procedure was performed and Park and Oh¹⁴ in which loop muscle reunion procedure was done. This correction was even higher than that achieved after the Hummelsheim procedure.^{17,23,24}

In our study, there was no case with LR atrophy in MRI. However, Nishida et al. reported 50 % of their cases with LR atrophy.¹³ 50% of our cases had regained binocular single vision in primary position with increase in abduction. It was same as that reported by Selezinka et al.¹⁵ but lower than that of Jensen, who reported 68.8% cases regaining the fusion.¹²

High occurrence of unilateral abducent nerve palsy have been reported.^{3,5} Large population group study like Rush and Younge³ and Shrader and Schlezinger⁵ have reported only 8% and 5% bilateral abducent nerve palsy.

Similar to these finding, all of our cases were unilateral except one that had bilateral presentation. Similarly, literatures^{6, 25, 26} also reports higher male preponderance and higher frequency of head injury in male resulting to abducent nerve palsy.²⁷ This might be the reason we have trauma as the commonest etiology with majority of cases being male. The mean age at surgery in our study was higher than that reported by Selezinka et al.¹⁵ and Frueh and Henderson,¹⁶ but the mean duration of palsy was lower in our study than that of the comparing literature.¹⁵

Cosmetic and Satisfaction Questionnaire helped assessed the satisfaction level of the patients regarding ocular alignment and cosmesis after the surgery. We found 87.5% of patient to be satisfied with ocular alignment and cosmesis, which was identical to that reported by Jensen.¹² Other literatures have also reported high cosmetic satisfaction following this procedure.^{16, 28}

In the context of our country, this will be the first study to report patient satisfaction following surgery for paralytic strabismus as Sharma et al.²⁹ who reported cosmetic acceptance in horizontal strabismus surgery had excluded paralytic strabismus in their study.

Conclusion

Even with the small number of samples, accounting for the rarity of such cases it can be inferred from our study that Jensen's procedure can successfully correct a large amount of deviation due to complete abducent nerve palsy with improvement in functionality, abduction deficit, and cosmesis.

Conflict of Interest: None

Acknowledgements: None

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