Case Report

Extracranial-Intracranial Bypass(EC/IC) for Symptomatic Occlusive Cerebrovascular Disease Not Amenable to Carotid Endarterectomy A Case of Report

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Abstract

Extracranial-Intracranial (EC/IC) by pass surgery was expected to solve all types of cerebral ischemia with angiographic demonstration of any degree of stenosis or occlusion where end arterectomy was not applicable. The purpose of extracranial to intracranial (EC-IC) bypass is to augment cerebral blood flow. A 35 years old right handed young shoulder underwent EC/IC bypass surgery for atherosclerotic occlusion of left ICA and MCA. It was carried out successfully with significant improvement of motor power and dysphasia.

Introduction

EC-IC bypass has been carried out as treatment for stroke for past 30 years1. The purpose of extracranial to intracranial (EC-IC) bypass is to augment cerebral blood flow[1, 2, 3, 4]. This procedure entails connection of the superficial temporal artery (STA), or a venous conduit, to a branch of the middle cerebral artery (MCA). Carotid end arterectomy is an alternative established and effective procedure for stroke prevention in severe stenotic lesions of the carotid artery in the neck. This procedure is not feasible for 20-30 percent of occlusive disease. These includes total occlusion of carotid above the level of the mandible and occlusion of the middle cerebral artery. The first EC-IC bypass was performed by Yasargil, in Zurich, Switzerland, in 1967[1]. Following in his footsteps, other talented cerebrovascular surgeons in the United States adopted the procedure during the 1970's, and its use expanded to most major neurosurgical centers around the world[1,2]. Yasargil showed that anastomosis of the superficial temporal artery to a small cortical branch of middle cerebral artery was feasible[1]. The indications for EC-IC bypass are severe stenosis or occlusion of intracranial arteries (fig-1) with focal neurological symptoms, such as weakness or speech difficulties. This procedure is also used when an artery must be surgically occluded for the treatment of unclippable giant aneurysms[3,4]. In children, this procedure is used to treat Moya-moya disease (a progressive).

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Case Report

A 35 years old right handed, nondiabetic, normotensive, nonasthmatic man got admitted in neurosurgery dept of BSMMU with the complaints of headache, right sided weakness for 6 months, slurring of speech for 4 months and recurrent episodes of unconciousness for same duration.

Headache was moderate to severe, dull aching in nature, located whole over the head specially left parietal region and relieved on taking rest and in lying position. He had no h/o trauma. He gave h/o episodes of unconciousness which persist for 2-3 min associated with generalized tonic clonic convulsion, occasionally associated with tongue bite and bladder bowel incontinence. He also gave h/o memory loss in the form of short term as well as long term memory. All the findings of the general examinations were within normal limit.

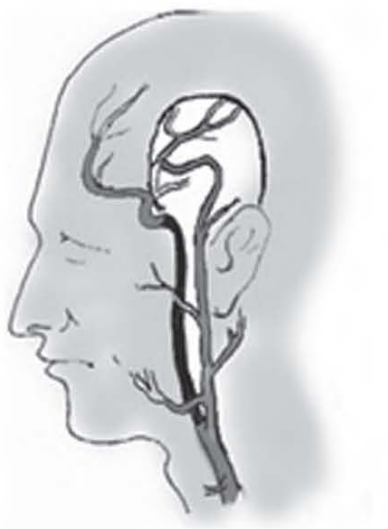

Fig 1: Diagramatic view occlusion ov ICA and EC/IC bypass.

His nervous system examination revealed-Higher psychychic function-Normal except short term and long term memory loss. Speech was slurred Gait was normal. Muscle power of right sided upper and lower limbs grade 4, Sensory intact. Jerks normal. All the cranial nerves functionally intact There were no bowel and bladder incontinence.

Routine blood investigations were within normal limit. X-ray of the skull showed normal. CT scan of brain showed ischemic infarct of fronto-parietal region (fig-2). CT angiogram of the brain showed complete occlusion of left internal carotid artery above the neck (fig-3) and left MCA is partially visualized from contralateral flow (fig-3). Transcranial color doppler study showed reduced perfusion to the left hemisphere than right (fig-4) & (Table-1).

Fig2: CT revealed the infarct of fronto-parietal lobe.

Fig 3: CT Angiogram shows the total occlusion of left ICA and stenosis and partial visualisation of left MCA by contralateral flow.

Preoperative data

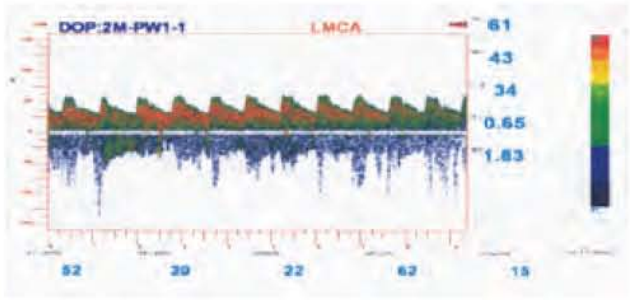

Fig4: Preoperative MCA waveform shows reduced flow.

Table 1: data analysis of all the major intracranial vessels shows reduced flow over left MCA, reversed flow over left ACA, NO FLOW OVER THE left ICA.

TCD data:
(in the table, the unit of PK, MN and E.D. is cm/s, Depth's unit is mm, others have no unit)

Vessel	DEPTH	PK	MN	E.D.	P.I.	R.L.	SBI	SD	Direction
LMCA	52	81	56	44	0.66	0.46	0.23	1.84	Toward
RMCA	52	106	81	69	0.46	0.35	0.34	1.55	Toward
LACA	62	53	32	22	0.97	0.59	0.56	2.44	Backward
RACA	62	78	56	45	0.58	0.42	0.39	1.72	Backward
LPCA	67	70	46	35	0.75	0.50	0.49	2.01	Toward
RPCA	67	53	34	24	0.86	0.55	.055	2.21	Toward
LVA	62	41	29	23	0.61	0.43	.043	1.77	Backward
RVA	62	45	29	21	0.86	0.54	0.49	2.17	Backward
BA	75	47	33	27	0.61	0.43	0.40	1.77	Backward
LOA	47	39	25	17	0.89	0.56	0.54	2.27	Toward
ROA	47	21	15	12	0.62	0.44	0.40	1.78	Toward
LCCA	0	21	13	10	0.83	0.54	0.49	2.15	Toward
RCCA	0	33	14	4	2.00	0.87	0.71	7.93	Toward
LECA	0	29	14	6	1.62	0.78	0.61	4.50	Backward
RECA	0	67	34	18	1.45	0.74	0.63	3.82	Backward
LICA	0	24	11	4	1.81	0.82	0.78	5.53	Backward
RICA	0	47	31	24	0.74	0.49	0.45	1.98	Backward

Postoperative data

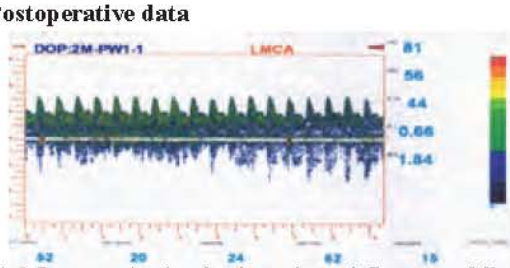

Fig5: Postoperative doppler shows the peak flow wave following EC/IC Bypass.

Technique

Left sided pterional craniotomy was performed to expose the intracranial vessels. The donor artery was exposed from scalp. This was performed under the operating microscope. First we identified and dissect the superficial temporal artery. Then we select parietal branch of STA. Transsylvian approach was performed by pterional craniotomy. After gentle dissection of sylvian fissure, MCA and its bifurcation were identified. Two temporary aneurysm clip wer applied in the trunk of M2 before its division. A small hole was made along it's long axis. After that we mobilize the donar artery near to the M2. Then end to side anasmosis was performed by 7/0 prolene. Temorary clips were removed. A key hole was maintained in the dural flap and bone to prevent the collapsing of the donar artery.Finally haemostsasis was secured and closed in layers. Postoperative recovery was uneventful. After 2 weeks of bypass, we did transcranial color doppler and it shows increased blood flow to the MCAand hence to left cerebal hemisphere(table-2) & (fig-5). Patient has improved his motor power and speech was also came to normal (fig -6).

Table: 2. Postoperative doppler data analysis revealed blood flow was increased in the left MCA in comparison to previous findings following EC/IC Bypass.

TCD data: (in the table, the unit of PK, MN and E.D. is cm/s, Depth's unit is mm, others have no unit)

Vessel	DEPTH	PK	MN	E.D.	P.I.	R.L.	SBI	SD	Direction
LMCA	52	61	43	34	0.65	0.45	0.45	1.83	Toward
RMCA	52	86	60	46	0.66	.046	0.46	1.85	Toward
LACA	65	106	74	58	0.65	0.45	0.05	1.83	Toward
RACA	62	102	71	55	0.66	0.46	0.03	1.84	Backward
LPCA	67	72	51	40	0.64	0.45	0.44	1.82	Toward
RPCA	67	53	35	27	0.73	0.49	0.47	1.96	Toward
LVA	64	32	22	18	0.64	0.45	0.43	1.81	Backward
RVA	62	41	29	23	0.63	0.44	0.43	1.80	Backward
BA	75	48	34	26	0.64	0.45	0.44	1.81	Backward
LOA	48	24	14	8	1.15	0.65	0.63	2.88	Toward
ROA	47	33	19	13	1.06	0.62	0.59	2.65	Toward
LCCA	0	39	19	9	1.52	0.76	0.62	4.09	Backward
RCCA	0	34	16	7	1.63	0.78	0.69	4.56	Backward
LECA	0	19	8	3	1.85	0.83	0.71	5.82	Backward
RECA	0	78	53	42	0.65	0.46	0.38	1.84	Backward

Discussion

A brain bypass is equivalent with heart bypass. It reinitiates blood flow in a blocked or damaged or an abnormal blood vessel. As a result corresponding brain region will get adequate blood supply. As it is formed from out side to inside head it is known as Extracranial to Intracranial (EC-IC) Bypass[5]. In patients with ICA occlusion and reduced cerebrovascular reserve capacity (CVR), revealed by different technical modalities such as MRI, PET, the EC-IC bypass can apparently prevent recurrent ischemic attacks[5,6].

There are several studies available which suggest hemodynamic failure can be predicted in patients with occlusive cerebrovascular disease, or those prior to therapeutic carotid occlusion, using SPECT scanning, Xenon CT scanning or positron emission tomography (PET)7. More importantly, it has been shown that EC-IC bypass has the potential to reverse the hemodynamic failure and normalize cerebral blood flow (CBF) 7, 8.

Fig. 6: postoperative picture of the patient shows almost equal motor power in both hands.

Grubb, have recently demonstrated that patients with an occluded ICA and ipsilateral increased oxygen extraction fraction (the fraction of oxygen in the blood that the brain extracts to maintain metabolism) by PET scanning have a significantly increased risk of future stroke[7].This patient population for instance, may be better served by EC-IC bypass[7,8,9]. We feel EC-IC bypass has a definite role in the treatment of ischemic stroke in carefully selected patients fulfilling very strict criteria. Brain bypass is carried out for two main resions:

1. Symptomatic blockage or occlusion or traumatic injury of major brain artery such as the internal carotid artery or middle carotid artery.
2. A brain aneurysm that cannot be obligated successfully using a clip or coil but instead its parent artery require to be sacrificed for the aneurysm to be effectively treated [8,9].

The EC-IC bypass is well planned methodilogically sound surgery. STA-MCA bypass has a definitive role in the treatment of ischemic stroke.

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