



## Outcomes of carotid endarterectomy with primary closure

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**Significance:**

Cerebrovascular ischemic cases are 3<sup>rd</sup> leading cause of fatality and neurologic dysfunction in adults. Atherosclerotic lesion outside the carotid cranial circulation are main cause of cerebral ischemia in almost 10-20 percent cases and carotid endarterectomy (CEA) has been proved beneficial for patients with severe carotid artery stenosis to prevent acute cerebrovascular events.

**Abstract**

**Background:** Cerebrovascular ischemic cases are 3<sup>rd</sup> leading cause of fatality and neurological dysfunction in adults. Atherosclerotic lesions outside the carotid cranial circulation are the main cause of cerebral ischemia in almost 10-20 percent cases, and carotid endarterectomy (CEA) has been proven to be beneficial for patients with severe carotid artery stenosis to prevent acute cerebrovascular events.

**Objective:** To assess short-term outcomes of carotid endarterectomy in patients with morbidities and mortalities at our institution during the study period.

**Materials and Methods:** This cross-sectional analytical study was carried out at the Combined Military Hospital, Rawalpindi, from August 2019 to July 2021, to analyze the short-term outcomes of carotid endarterectomy (CEA) with primary closure. All patients who underwent carotid endarterectomy (CEA) with primary closure during the study period were included in the study. Patients who underwent selective shunting if Electro Encephalogram (EEG) changes were noted were excluded from the study. Data were collected after verbal consent was obtained using a pre-formed questionnaire. The frequency of morbidities such as bleeding, infection, stroke, transient ischemic attack (TIA), Myocardial Infarction, repeat operation, and revision with stent were noted within a postoperative period of one month. The frequency of mortality in the month postoperative period among the patients undergoing carotid endarterectomy was also calculated. Data were entered and analyzed using SPSS version 22.

**Results:** A total of 198 patients who underwent carotid endarterectomy with primary closure during the study period were included. The age range of the study participants was 35–80 years old. There were 107 (54.04 %) male patients. The comorbidities evaluated in the study participants showed that 172 (86.87%) patients were hypertensive and 73 (36.87%)

has diabetes mellitus. The most frequent postoperative morbidities among the patients were bleeding and repeated operations.

**Conclusion:** Carotid endarterectomy with primary closure is a safe and effective surgical method for preventing stroke.

**Introduction**

Worldwide, Cerebrovascular ischemic cases are the third largest cause of fatality in adults and the primary cause of neurologic dysfunction. Atherosclerotic lesions in the extracranial carotid circulation are responsible for 10-20% of cerebral ischemia cases (1). Although carotid endarterectomy (CEA) has been shown to reduce the risk of acute cerebrovascular episodes in individuals with severe carotid artery stenosis, the most effective surgical method remains debated (2,3). Stenosis of the internal carotid artery also increases the stroke risk in symptomatic and asymptomatic patients. Carotid endarterectomy (CEA) is a surgical procedure that has been beneficial in reducing the risk of stroke in both symptomatic and asymptomatic patients with internal carotid artery stenosis. Different surgical procedures, on the other hand, may have an impact on short-term outcomes. Despite CEA's effectiveness and acceptance, there is still discussion regarding the best method for closure. Surgeons support patch angioplasty to reduce the risk of thrombosis of the internal carotid artery by increasing the size of the lumen and ultimately reducing the risk of perioperative stroke (4).

Comorbidities such as diabetes mellitus, dyslipidemia, hypertension, tobacco abuse, and percutaneous coronary intervention (PCI) enhance complex coronary artery disease or diffusely diseased carotid artery among patients presenting for surgical revascularization. In patients with a diffusely diseased carotid artery, a distal anastomosis to a non-diseased segment is frequently difficult to perform rather in these cases, and carotid endarterectomy (CE) may be an effective surgical option. Carotid endarterectomy (CE) was first introduced by Bailey et al. in 1957. Initially, increased operative morbidity and death were observed during the procedure. Even in a recently published meta-analysis of 63,730 patients, Wang et al. reported that CE-CABG increased 30-day mortality from 2.8% to 5.4%. Perioperative management outcomes of CE have been

reported to be improved with advancement in surgical techniques (5, 6, 7, 8).

This study aimed to evaluate the short-term outcomes of carotid endarterectomy performed at our institution during the study period in terms of morbidity and mortality.

#### Objective

This study aimed to assess the short-term outcomes of carotid endarterectomy in patients in terms of morbidity and mortality at our institution during the study period.

#### Materials and Methods

This cross-sectional analytical study was conducted at the Combined Military Hospital, Rawalpindi, from August 2019 to July 2021, after obtaining ethical approval from the institutional ethical review committee to analyze the short-term outcomes of carotid endarterectomy (CEA) with primary closure. All patients who underwent carotid endarterectomy (CEA) with primary closure during the study period were included in the study. Patients who underwent selective shunting if Electro Encephalogram (EEG) changes were noted were excluded from the study. Data were collected after verbal consent was obtained using a pre-formed questionnaire. Demographic characteristics (age, sex) and comorbidities, such as hypertension, diabetes mellitus, coronary artery disease, dyslipidemia, and tobacco abuse, were evaluated in all patients undergoing carotid endarterectomy. The frequency of morbidities such as bleeding, infection, stroke, transient ischemic attack (TIA), Myocardial Infarction, repeat operation, and revision with stent were noted within a postoperative period of one month. The frequency of mortality in the month postoperative period among the patients undergoing carotid endarterectomy was also calculated. Data were entered and analyzed using SPSS version 22. The chi-square test was used to determine any statistical difference between the groups. Statistical significance was set at  $P < 0.05$ .

#### Results:

A total of 198 patients who underwent carotid endarterectomy with primary closure during the study period were included. The age range of the study participants was 35–80 years old. Out of the 198 patients, 107 (54.04%) were male and 91 (45.96%) were female. The comorbidities evaluated in the study participants showed that 172 (86.87%) patients were hypertensive and 73 (36.87%) had diabetes mellitus, coronary artery disease, dyslipidemia, and tobacco abuse frequency in 103 (52.02%), 139 (70.20%), and 135 (68.18%) patients, respectively (Table I).

**Table I: Demographic characteristics and comorbidities among patients undergoing endarterectomy (n=198)**

| Characteristic           | Frequency (Percentage) |
|--------------------------|------------------------|
| Age (Range in years)     | 35-80 years            |
| Male                     | 107 (54.04%)           |
| Female                   | 91 (45.96%)            |
| Hypertension             | 172 (86.87%)           |
| Diabetes mellitus        | 73 (36.87%)            |
| Coronary artery diseases | 103 (52.02%)           |
| Dyslipidemia             | 139 (70.20%)           |
| Tobacco abuse            | 135 (68.18%)           |

The postoperative frequencies of various comorbidities among patients who underwent carotid endarterectomy with primary closure were observed in 22 (11.11%) patients in one month duration. The most frequent postoperative morbidities among the patients were bleeding and repeat operations in 2.52% of patients. Myocardial infarction was in 1 (0.50%). Other observed comorbidities were infection 2 (1.01%), stroke 4 (2.02%), transient ischemic attack (2.02%), and revision with stent 2 (1.01%). Of the 198 patients, six (3.03%) died within one-month postoperative period (Table II).

**Table II: Frequency of Postoperative morbidities and mortalities among patients undergoing endarterectomy**

| Comorbidities and mortalities   | Frequency (Percentage) |
|---------------------------------|------------------------|
| Bleeding                        | 5 (2.52%)              |
| Infection                       | 2 (1.01%)              |
| Stroke                          | 4 (2.02%)              |
| Transient Ischemic attack (TIA) | 4 (2.02%)              |
| Myocardial Infarction (MI)      | 1 (0.50%)              |
| Repeat operation                | 5 (2.52%)              |
| Revision with stent             | 2 (1.01%)              |
| Death                           | 6 (3.03%)              |

#### Discussion

Carotid Endarterectomy (CEA) is one of the most effective methods of stroke prevention. However, the literature reveals that it is arguable whether patch

angioplasty or primary closure is beneficial for lowering the incidence of postoperative restenosis and complications such as stroke, transient ischemic attacks (TIA), Myocardial Infarction (MI), and fatality. Some studies have shown that patch angioplasty reduces the occurrence of acute thrombosis in the short term owing to an increase in lumen size, which also reduces the risk of perioperative stroke. However, there are also hazards of patch closure including hemorrhage and infection (9,10,11). Our study findings revealed that out of 198 surgeries, 22 were noted to have complications within the 30-days postoperative period, including bleeding, infection, stroke, TIA, and myocardial infarction. The incidence of death in the study population was 3.03% patients. The rate of short-term complications after endarterectomy is lower than that reported by Oldham et al. (12), which may be attributed to the advancement of knowledge, surgical techniques, and latest technologies used in newly equipped operation theatres. We suggest that carotid endarterectomy with primary closure is associated with lower complication rates. Many studies have shown that CEA is effective in preventing stroke; nevertheless, there is still controversy regarding whether patch angioplasty or primary closure is the best strategy for reducing postoperative restenosis and associated consequences, such as stroke, TIA, MI, and mortality (13,14).

The main limitation of the study was that it was a cross-sectional study with a small sample size, and there was no long-term follow-up for long duration to accurately identify the frequency of postoperative complications among patients undergoing carotid endarterectomy. Another important limitation of the study is that the complication rate with other techniques was not compared.

### Conclusion

Our study findings indicate that carotid endarterectomy along with primary closure for stroke prevention is safe and effective.

**Conflict of interest:** Authors do not have any conflict of interest to declare.

**Disclosure:** None

**Human/Animal Rights:** No human or animal rights were violated during this study.

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