Carotid Endarterectomy:
A Report of 7854 Procedures Using Local Anesthesia, Electroencephalographic Monitoring, Occlusion Catheters, and the Pruitt–Inahara Carotid Shunt

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Accumulation of data through prospective studies has seemed painstakingly slow, but during the past 25 years several major prospective studies have published results conclusively demonstrating that carotid endarterectomy is superior to medical management in certain categories of patients with carotid stenosis. These prospective studies are as follows: (1) the Joint Study of Extracranial Arterial Occlusion; (2) the North American Symptomatic Carotid Endarterectomy Trial (NASCET); (3) the European Carotid Surgery Trial (ECST); (4) the V.A. Symptomatic Carotid Endarterectomy Trial; and (5) the Asymptomatic Carotid Atherosclerosis Study (ACAS).

The Joint Study of Extracranial Arterial Occlusion[1]: This early prospective study was carried out in 23 major teaching hospitals and reported in 1970 that carotid stenosis was more common than previously thought; endarterectomy could reduce the risk of stroke for certain groups of patients including those with transient ischemic attacks.

The North American Symptomatic Carotid Endarterectomy Trial (NASCET)[2]: Interim results of this study of symptomatic patients were reported on February 21, 1991. The NASCET investigators concluded that carotid endarterectomy was highly beneficial for patients with recent hemispheric transient ischemic attacks or non-disabling strokes and ipsilateral 70% to 99% stenosis. The operation provided a 17% absolute risk reduction for this

group of patients. Those with a 0% to 30% obstruction did not benefit from surgery.

The European Carotid Surgery Trial (ECST)[3]: This multicenter trial published results in 1991 detailing a beneficial effect of surgery for patients with 70% to 99% stenosis who were symptomatic. Patients with 0% to 29% stenosis did not benefit from surgery. The conclusions of the ECST were similar to those of the NASCET group.

The V.A. Symptomatic Carotid Endarterectomy Trial[4]: This prospective study demonstrated findings similar to the NASCET study and the ECST study. The benefit of surgery appeared to be greatest in patients with internal carotid artery stenosis of greater than 70%.

The Asymptomatic Carotid Atherosclerosis Study (ACAS)[5]: Begun in 1987, this study had preliminary results reported on September 29, 1994, and detailed results on May 10, 1995. This study included patients with a 60% to 99% obstruction in a carotid artery who were asymptomatic. Regarding this study, the National Institute of Neurological Disease and Stroke Clinical Advisory (NINDS) stated: "Carotid endarterectomy, performed in medical centers with documented combined perioperative morbidity and mortality for asymptomatic endarterectomy of less than 3%, and on carefully selected patients who continue to have aggressive, modifiable risk factor management is beneficial for patients who meet eligibility criteria for asymptomatic carotid stenosis exceeding 60% diameter reduction confirmed by arteriography."[6]

The significance of these major prospective studies is hard to overstate. Stroke is the third leading cause of death in most developed nations. In the United States alone, approximately 550,000 people have a stroke each year, resulting in 150,000 deaths. In addition, 300,000 patients are left permanently disabled but do not die, requiring prolonged rehabilitation.[7] Families are disrupted and required to endure severe emotional and economic burdens.

The carotid bulb and the internal carotid artery just above the bifurcation are recognized as the most important sites for an atherosclerotic process leading to transient ischemic attacks or strokes. Cerebral infarction accounts for 85% of strokes. Of those, 50% are thought to be the result of carotid stenosis.[8] Multiple studies have shown transient ischemic attacks to be serious warning signals for stroke risk. In a 15-year study by Whisnant, 35% of patients with a TIA had subsequent stroke; 51% of those had a stroke within one year of the TIA, and 21% had the stroke within the first month of the TIA.[9] It is well recognized, however, that nearly half of patients who have a stroke do not have a transient attack prior to the stroke. Ten to 15% of cerebral infarctions are silent. Many patients who have a TIA with complete recovery have residual infarctions on CT or MRI brain scan.[8] In addition, asymptomatic stenosis sometimes proceeds to total occlusion which is not usually correctable.

For these reasons, the results of the Asymptomatic Carotid Atherosclerosis Study (ACAS) are extremely important and require an attempt to be made to diagnose and treat significant carotid stenosis prior to the development of transient ischemic attacks or stroke.

Table 1.

Recommended acceptable limits of combined morbidity and mortality due to stroke during or following endarterectomy

(A) Asymptomatic stenosis	3%
(B) Transient ischemic attacks	5%
(C) Previous ischemic stroke	7%
(D) Recurrent carotid stenosis	10%
(E) Mortality for all groups	2%

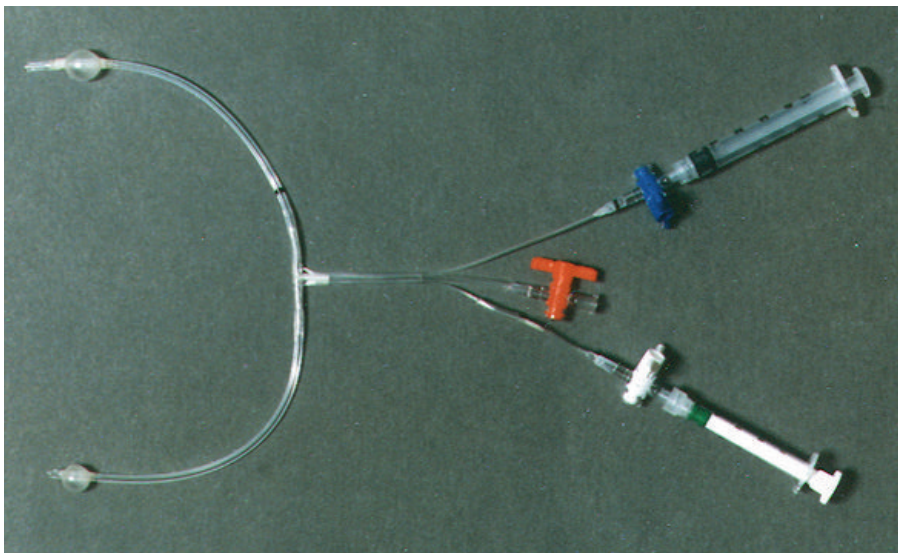

Figure 1. Pruitt–Inahara Model 400-40 Carotid Shunt with side port.

A decision to recommend carotid endarterectomy for the prevention of stroke can be made in those patients who have a 60% or greater stenosis, symptomatic or asymptomatic, if there are no serious medical problems to contraindicate the procedure. In the ACAS study it was stated that the benefits derived from the operation were dependent upon surgeons having documented a perioperative morbidity or mortality of less than 3% along with a careful selection of patients and postoperative management of modifiable risk factors.

Recommended acceptable limits of combined morbidity and mortality due to stroke during or following endarterectomy are listed in Table 1.[2,5,10]

This report details the development of a technique for carotid endarterectomy which appears to meet those acceptable limits of risk obtained in a large series of patients and discusses the results. All operations were done by a single surgeon.

Between July 1, 1963, and June 5, 1995, the author performed 7,854 carotid endarterectomies on 5,563

patients. The data is presented in this paper in three parts: (1) An Early Study consisting of 1,130 endarterectomies done between July 1, 1963, and August 31, 1979, using general endotracheal anesthesia and sometimes shunting with the Javid shunt. (2) A Later Study consisting of 6,724 carotid endarterectomies performed between September 1, 1979, and June 5, 1995, using cervical block anesthesia, EEG monitoring, balloon occlusion catheters, and selective shunting with the Pruitt–Inahara internal shunt. (3) The Total Study including results of 7,854 operations done between July 1, 1963, and June 5, 1995.

Because of a dissatisfaction with existing shunts, a new type of shunt was developed utilizing balloons, instead of clamps, to hold the shunt in place. The shunts were equipped with a side-port to get rid of particles which often get into shunts when they are inserted.

On September 1, 1979, consultation was requested on a patient who was having recurrent transient ischemic attacks and whose cardiac status was so poor that the cardiologist and pulmonologist insisted that the patient be operated upon under cervical block anesthesia rather than general anesthesia. With some trepidation the operation was scheduled. There was apprehension that cervical block might be poorly tolerated by the patient or the patient might even try to get off the table during surgery. This patient, however, cooperated completely during the procedure and denied having any discomfort whatsoever. She was able to talk throughout the procedure, providing reassurance that there was no cerebral ischemia during clamp-off time. Experience with that first case of cervical block was so positive that cervical block anesthesia was recommended to all of the succeeding patients in the series. Those patients who admitted to having claustrophobia or who had a large, short neck or who expressed a desire to have a general anesthetic were given general anesthesia instead of cervical block. Cervical block was accepted and used on 5,724 patients between September 1, 1979, and June 5, 1995. At the same time that cervical block anesthesia was adopted, EEG monitoring was begun. In addition, an occlusion catheter was used in the internal carotid artery instead of clamps in an effort to reduce trauma to the intima. The carotid endarterectomies done between September 1, 1979, and June 5, 1995, therefore, involved a change in technique to local (cervical block) anesthesia with electroencephalographic monitoring and selective shunting with the Pruitt–Inahara Carotid Shunt, Model 400-40. In addition, a balloon occlusion catheter was used prior to insertion of the shunt, or instead of the shunt if no shunt was needed. In this Later Study, 6,724 endarterectomies were performed on 4,862 patients.

THE SHUNT

The Pruitt–Inahara Shunt, Model 400-40, is 30 cm in length and is an outlying type shunt. The balloon on the proximal end of the shunt usually requires 1.0 mL to 1.25 mL of normal saline to secure placement of the balloon in the common carotid artery so that it will not slip. The balloon on the distal end of the shunt usually requires 0.25 mL or less, depending upon the size of the vessel (Fig. 1).

PREOPERATIVE EVALUATION

All patients had medical and neurological evaluation prior to surgery, and most had CT brain scan or MRI brain scan to evaluate for previous strokes and to rule out brain tumors or other pathology. Preoperative electroencephalograms were done in the operating room prior to the operative procedure. Diagnosis was made with carotid ultrasound and confirmed with arteriography (usually digital subtraction arteriography). Indications for carotid work-up are presented in Table 2.

Indications for Carotid Workup
Prior to Surgery

	Previous CVA Number	%	TIA Number	%	Asymptomatic Bruit Number	%
Early Study 1130 Endarterectomies 7\1\63 - 8\31\79	158	14	861	76	109	10
Later Study 6724 Endartectomies 9\1\79 - 6\5\95	1340	20	4134	61	1252	19
Total Study 7854 Endartectomies 7\1\63 - 6\5\95	1498	19	4995	64	1361	17

Table 2.

Age of Patients in Study
Age at time of procedure

AGE	NUMBER	%
30 - 39	4	0
40 - 59	533	7
60 - 79	5746	73
80 - 99	1571	20
TOTAL	7854	100

Table 3.

Anesthesia

Comparison of General vs. Cervical Block

	General Anesthesia		Cervical Block	
	number	%	number	%
Early Study	1130	100.0	0	0.0
Later Study	1000	14.9	5724	85.1
Total Study	2130	27.1	5724	72.9

Table 4.

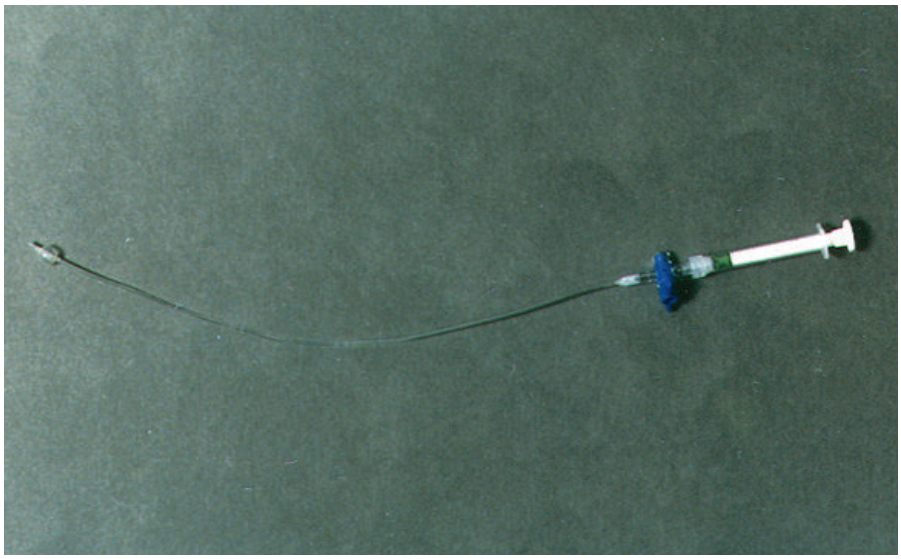

Figure 2. Pruitt occlusion catheter (No. 5 French).

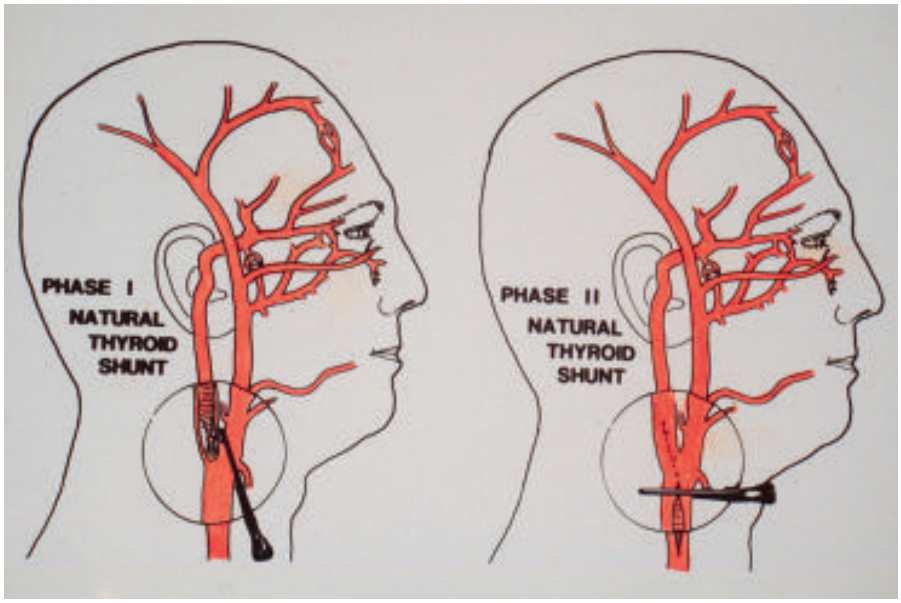

Figure 3. Views of position of bulldog clamps allowing maximum collateral circulation to the brain.

AGE OF PATIENTS

The ages of the patients in the study at the time of the procedure varied from 32 to 96 years. The number and percentage of patients in each age group are listed in Table 3. There were 62 procedures done on patients who were 90 years old or older. There was one surgical death in that group.

ANESTHESIA

In the Early Study of 1,130 endarterectomies performed between July 1, 1963, and August 31, 1979, no operations were done under local anesthesia. In the Later Study between September 1, 1979, and June 5, 1995, of 6,724 endarterectomies, 5,724 were done under local anesthesia using cervical block. One thousand (1,000) cases were done under general endotracheal anesthesia. If the patient was frightened or had claustrophobia, general anesthesia was preferred (Table 4).

The cervical block procedure consisted of an injection of 20 to 25 mL of Carbocaine 1% or a mixture of Xylocaine with Marcaine. The anesthesia usually lasted 1½ to 2 hours. If the patient had anxiety during the procedure, Valium was given intravenously in 1.0 mg increments or Versed in 0.5 mg increments until the anxiety was relieved.

EEG MONITORING TECHNIQUE

A continuous 16-channel EEG tracing was begun prior to the making of the incision and continued until the procedure was completed. The intraoperative interpretation was performed by a registered EEG technician and was officially read by the neurologist postoperatively. In most cases, the EEG tracing was normal throughout the operative procedure, and the patient was alert and able to move the contralateral extremities; the stump pressure appeared adequate. In some instances, however, the electroencephalogram appeared normal, but the patient was unable to speak or move the contralateral extremities. In other cases, the EEG showed ischemia, but the patient was still able to speak and move the contralateral extremities. No single monitoring parameter was considered to be reliable, so an internal shunt was used if any parameter indicated ischemia.

OCCLUSION CATHETERS IN THE INTERNAL CAROTID ARTERY

In the Later Study of 6,724 cases done between September 1, 1979, and June 5, 1995, an occlusion catheter was used in the internal carotid artery. No clamps were placed on the internal carotid artery. The occlusion catheter was a No. 5 Fr. catheter 25 cm in length. It usually required 0.25 mL of saline or less to occlude the internal carotid artery. This smaller catheter was considerably less traumatic to the intima of the internal carotid artery than an arterial clamp and allowed control of backbleeding regardless of the extent of the plaque, making higher lesions easier to handle safely. The occlusion catheter was smaller and easier to work around than any internal shunt and also allowed clearer visualization of the endpoint than was obtainable when an arterial clamp was used. The endpoint was clearly visible without extending the arteriotomy high on the internal carotid and thereby reduced the number of cases requiring a patch graft (Fig. 2).

OPERATIVE TECHNIQUE

The patient was given intravenous sedation with Versed. The head was turned away from the side to be operated on, and the neck was extended. An incision was made along the anterior border of the sternocleidomastoid muscle, and dissection was carried through the platysma and deepened just anterior to the internal jugular vein. Care was taken not to injure the mandibular branch of the facial nerve. The branches of the internal jugular vein crossing the carotid artery were double-clamped, divided and ligated. A vessel loop was gently placed around the carotid artery, and sutures of 2-0 black silk were placed around the external and internal carotid arteries for control. The suture technique required less manipulation of the external and internal carotid arteries for control than did placement of vessel loops around these vessels. The hypoglossal nerve, vagus nerve, and superior thyroid artery were identified and protected. The superior thyroid artery was not ligated either temporarily or permanently. The superior thyroid artery has been found to be an important source of collateral circulation during carotid endarterectomy.[11]

Care was taken to manipulate the carotid artery and its branches as little as possible so as not to dislodge debris from an ulcerated plaque. Ten thousand (10,000) units of sodium heparin were given intravenously, and after three minutes the surgeon asked the EEG technician if the electroencephalogram appeared normal. The surgeon then asked the anesthesiologist if the blood pressure was at least as high as the patient's normal blood pressure. A request was made for the anesthesiologist to ask the patient to squeeze his contralateral hand and to confirm that the heparin had been given. If all seemed to be in order, the common carotid artery was clamped with a strong spring bulldog, and the external carotid artery was clamped with a spring bulldog at an angle, allowing the superior thyroid artery to continue feeding the external carotid artery. No clamps were placed on the internal carotid artery. On one occasion, while still using clamps instead of occlusion catheters, the patient embolized and had a stroke immediately following application of the clamp on the internal carotid artery. One of the advantages of doing carotid endarterectomies under local anesthesia with electroencephalographic control is that complications can be noted immediately and technique can be changed to prevent future problems. The arteriotomy incision was made far laterally on the common carotid artery extending onto the bulbous portion of the internal carotid artery. In many patients the arteriotomy incision did not extend superiorly above the distal extent of the plaque. A 5-mm balloon occlusion catheter was inserted

Shunts

Number of Cases Shunted

Early Study	7\1\63 - 8\31\79	414 shunted = 36.6%	Javid Shunt
Later Study	9\1\79 - 6\5\95	1164 shunted = 17.3%	Pruitt Inahara
Total Study	7\1\63 - 6\5\95	1578 shunted = 20.1%	Javid Pruitt Inahara

Table 5.

Complications Post Op

Early Study 1130 cases under General Anesthesia
7\1\63-8\31\79

COMPLICATIONS	Number	%
Total Post Op CVA	39	3.5
Total CVA Not resulting in Death	26	2.3
Total CVA Resulting in Death	13	1.2
Total Deaths within 30 Days excluding CVA	23	2.0
Total Major Complications CVA or Death*	62	5.5

*All cases were performed under General Anesthesia with no monitoring and intermittent use of Javid Shunt

Table 6.

into the internal carotid artery, and the balloon was inflated with normal saline enough to stop back-bleeding from the internal carotid artery. If there were no EEG or clinical changes of ischemia and if the stump flow appeared adequate, the endarterectomy was completed without the insertion of an internal carotid shunt. If there were EEG or clinical changes of ischemia, an internal shunt was inserted adjacent to the occlusion catheter, and the occlusion catheter was then removed. The Pruitt–Inahara carotid shunt could be inserted first into the internal carotid or first into the common carotid since the catheter could be flushed out of the side-port from either direction before allowing blood to go to the brain. It is always preferable to examine carefully the flow of blood through the side-port from the common carotid before allowing blood to go to the brain because too much pressure in the balloon in the common carotid can occasionally reduce the flow. It was usually preferable to remove the plaque including all ulcerations prior to insertion of the shunt. The plaque in the internal carotid artery was clearly visible because the occlusion catheter was small and easy to work around and allowed easy visualization of the endpoint even with high lesions.

If the plaque was severely adherent or brittle and removal of it appeared as though it would take more than four minutes, it was necessary to extend the arteriotomy incision higher than the distal extent of the plaque so that the shunt could be inserted without fear of getting particles into the shunt itself. A dissector was used to find the appropriate plane for removal of the plaque, and the removal was from the most proximal part of the arteriotomy incision in the common carotid, proceeding distally into the external carotid first and then into the internal carotid artery. Small pick-ups were used to remove any particles which remained, keeping in mind that the endpoint in the internal carotid artery is the most important part of the procedure. There is no substitute for an adequate endpoint. All of the plaque must be removed. If there appears to be any plaque left which would need to be sutured, then the endarterectomy is not yet completed. Rarely should it be necessary to place any stitches in the internal carotid at the distal portion of the endarterectomized segment. The distal end ordinarily is quite smooth with a thin, well-attached intima above.

The carotid artery was flushed with heparinized saline solution after all plaque had been removed. The balloon on the occlusion catheter or on the Pruitt–Inahara internal shunt held the artery open so that the endpoint could be carefully visualized. A satisfactory endpoint was considered to be imperative. The external carotid artery was fully endarterectomized as well until there were no intimal flaps. When the endarterectomy was completed, the arteriotomy incision was repaired with 5-0 or 6-0 prolene suture beginning at the most cephalad portion of the incision on the internal carotid artery and extending caudad to a point below the bifurcation. When the arteriotomy incision was closed to an area about 0.5 cm below the bifurcation, the clamp from the external carotid artery was moved to the area just below the bifurcation, and the balloon occlusion catheter in the internal carotid artery was removed. This change in position of the bulldog clamp allows an increased amount of collateral circulation to go to the brain in cases where no internal shunt is being used. Blood from the branches of the external carotid artery will now feed the internal carotid artery, and there are very few people who have any ischemia in this configuration, which has been termed the "second phase of the natural thyroid shunt." Much of the collateral circulation comes from the superior thyroid artery and other branches of the external carotid (Fig. 6).

A second suture of 5-0 or 6-0 prolene was then begun on the proximal portion of the common carotid artery incision and sutured up to the first stitch, at

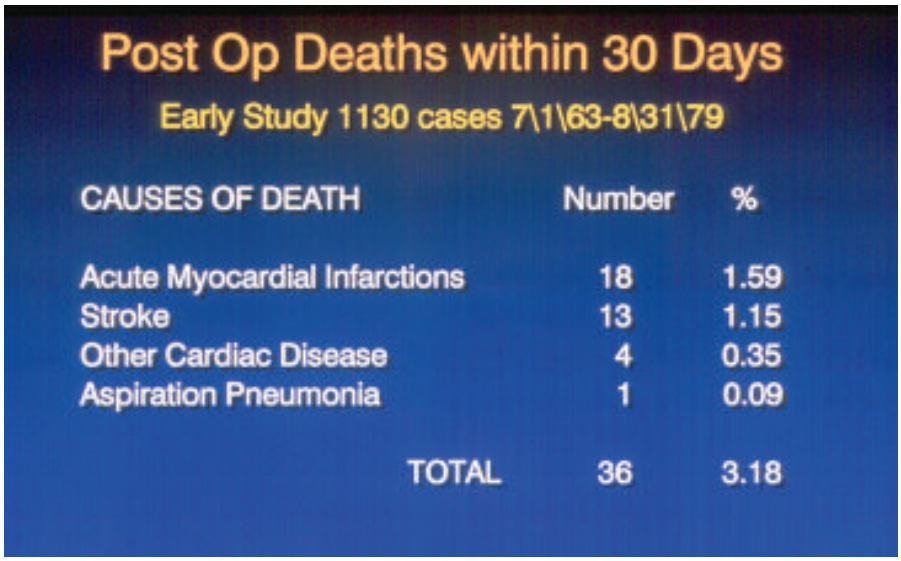

Table 7.

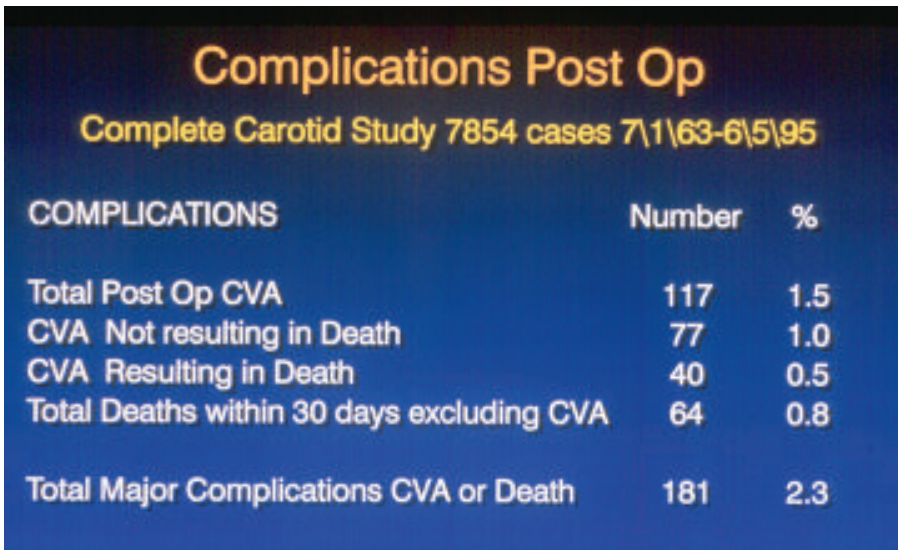

Table 8.

which time flushing was carried out from the common carotid artery and then from the external and internal carotid arteries before placing the last two stitches in the common carotid incision. The blood was then allowed to flow first through the external carotid and then through the internal carotid so that any debris or air was flushed into the face and scalp rather than the internal carotid. The patient was given 50 mg of protamine sulfate to reverse the heparin partially.

If an internal shunt had been used, the arteriotomy repair was done in the same manner, and the shunt was removed before placing the last two stitches. If the pulsation in the internal carotid artery felt normal and there were no thrills, the procedure was completed. In this series angioscopy was carried out on 25 patients, but no abnormal findings were diagnosed.

If after closure the flow did not feel adequate or if there was a palpable thrill, then it was considered necessary to reclamp the common carotid artery and external carotid artery as before, to reopen the artery, and to examine carefully for technical errors. If the artery was reopened, a Dacron patch was sutured onto the site of the arteriotomy incision to increase the size of the vessel. This was necessary in only four cases. Patients were still heparinized with approximately 5,000 units of sodium heparin active at the termination of the procedure. In addition, the patients were given 4,000 additional units of heparin over the ensuing 20 hours. Postoperatively, the blood pressure was carefully monitored, and the patients were observed for cardiac arrhythmias or respiratory disturbances or seizures. After leaving the recovery room, patients were usually placed in the progressive care unit or the intensive care unit.

Dacron patches were used in patients with very small arteries. A Jackson–Pratt 7-cm drain was inserted, and the platysma was re-approximated with 2-0 plain catgut interrupted sutures. Subcutaneous tissue was closed with 3-0 plain catgut, and the skin was closed with 2-0 black silk interrupted sutures and autosuture skin staples. Aspirin 5 grains daily was given to male patients, and Persantine 25 mg b.i.d. was given to female patients.

RESULTS

In the Early Study done between July 1, 1963, and August 31, 1979, there were 414 cases shunted with a Javid shunt. In the Later Study between September 1, 1979, and June 5, 1995, there were 1,164 cases shunted using the Pruitt–Inahara Balloon Shunt. Monitoring with local anesthesia and EEG, 17.3% of patients had cerebral ischemia and required a shunt. In the Total Study, 1,578 cases were shunted (Table 5).

COMPLICATIONS

In the Early Study of 1,130 cases done under general anesthesia with no monitoring, the total major complication rate was 5.5% (Table 6). In that study, the rate of postoperative deaths within 30 days was 3.18% (Table 7).

In the Later Study of 6,724 cases using primarily cervical block anesthesia, EEG monitoring, and selective shunting with the Pruitt–Inahara shunt, the total major complication rate was 1.8% (Table 8). The rate of postoperative deaths within 30 days in this group was 1.0% (Table 9).

In the Total Study of 7,854 endarterectomies, the major complication rate was 2.3% (Table 10). The rate of postoperative deaths within 30 days was 1.32% (Table 11).

In addition to the major complications of CVA or death, there were 54 episodes of TIA in the total series and 4 cases of apparent injury to a recurrent laryngeal nerve. There were two cases that blew out a saphenous vein patch requiring replacement with a Dacron Patch.

Post Op Death within 30 Days

Later Study 6724 cases 9\1\79-6\5\95

CAUSE OF DEATH	Number	%
Acute Myocardial Infarction	29	0.43
Stroke	27	0.40
Other Cardiac Disease	10	0.15
Ruptured AAA	1	0.01
Mesenteric Artery Thrombosis	1	0.01
TOTAL	68	1.00

Table 9.

Complications Post Op

Complete Carotid Study 7854 cases 7\1\63-6\5\95

COMPLICATIONS	Number	%
Total Post Op CVA	117	1.5
CVA Not resulting in Death	77	1.0
CVA Resulting in Death	40	0.5
Total Deaths within 30 days excluding CVA	64	0.8
Total Major Complications CVA or Death	181	2.3

Table 10.

DISCUSSION

Some of the differences in risk between the Early Study and the Later Study can be attributed to the additional experience of the surgeon prior to beginning the later series. There are many changes in technique during the later series, and the technique continues to evolve. It seems clear, however, that carotid endarterectomy can be performed with acceptable risk using local anesthesia, EEG monitoring, balloon occlusion catheters, and selective shunting with the Pruitt–Inahara carotid shunt. This technique is particularly helpful for those difficult cases with high lesions in the carotid artery. The Pruitt–Inahara internal shunt was found to have the following features:

- Flexibility; easy to work around
- Provides for minimal trauma to the intimas of the common and internal carotid arteries
- Provides good access even for high lesions
- Allows easy visualization of the endpoint
- Allows one to close almost the entire endarterectomy incision before removing it, reducing non-shunt clamp-off time
- Allows surgeon to flush-out debris through side-port before directing blood to the brain
- Allows surgeon to "trouble-shoot" to confirm good proximal flow and distal "backflow"
- Provides adequate blood flow to the brain in all cases
- Easy to use because balloons prevent it from dislodging

SUMMARY

Results of a series of 7,854 consecutive carotid endarterectomies done by a single surgeon were presented. In the study 5,724 of the endarterectomies were done under local (cervical block) anesthesia with EEG control and selectively shunted with the Pruitt–Inahara carotid shunt. With this method it was possible to determine exactly when complications occurred, allowing for a gradual change in technique to improve the safety of the procedure. It was concluded that in order to perform carotid endarterectomy with a minimum of risk, careful attention must be paid to a long list of items including the following:

1. Proper selection of patients
2. Timing of the operation
3. Preoperative preparation of the patient
4. Selection of anesthesia
5. Maintenance of adequate blood pressure and prevention of arrhythmias
6. Avoidance of manipulation of the vessels during dissection; consider using sutures rather than vessel loops for control
7. Avoidance of placing clamp on internal carotid artery
8. Go through check list before clamping off
9. Avoidance of occlusion of superior thyroid artery
10. Monitoring of more than one parameter during the procedure to avoid cerebral ischemia
11. Shunting when necessary with a balloon shunt
12. Utilization of a balloon occlusion catheter in the internal carotid artery before a balloon shunt is used
13. Forward and back-flushing of the shunt through a T side-port before allowing blood to go to the brain
14. Removal of all the plaque including the loose circular fibers of the media
15. Make the incision in the common and internal carotid arteries in the lateral position
16. Avoidance of making incision on internal carotid artery too high
17. Patch graft when internal carotid artery appears too small
18. Flushing adequately to prevent emboli
19. Allow blood to go out external carotid before internal carotid at the end of the procedure
20. Maintenance of low-dose heparin therapy for first 24 hours following surgery
21. Monitoring of patient postoperatively for arrhythmias or hypotension or severe hypertension STI

Post Op Deaths within 30 Days

Total Study 7854 Endarterectomies 7\163-6\5\95

CAUSE OF DEATH	Number	%
Acute Myocardial Infarction	47	0.60
Stroke	40	0.51
Other Cardiac Disease	14	0.18
Ruptured AAA	1	0.01
Mesenteric Artery Thrombosis	1	0.01
Aspiration Pneumonia	1	0.01
TOTAL	104	1.32

Table 11.

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