INSTRUMENTS FOR USE IN THE TREATMENT OF CERTAIN INTRACRANIAL VASCULAR LESIONS

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Clamps A and B to be described here are the first in a series of four with which we have been experimenting over a period of years in an effort to solve some of the problems presented by patients with intracranial aneurysms and other vascular anomalies. Clamp A has been used here and in other neurosurgical clinics over a period of three years, and now we believe it has been perfected to the degree that it can be recommended to others. Clamp B has been used for a shorter period of time, but long enough for us to know that it can be extremely useful in the treatment of some of the more difficult intracranial vascular lesions. Clamp C, for external control of blood flow through the intracranial portion of the internal carotid artery, and Clamp D, for gradual occlusion (external) of end arteries such as the middle cerebral, are in the experimental stage, but indications are that they will be worth-while additions to our armamentarium.

CLAMP A (Figs. 1 and 2)

This clamp serves the same purpose as the one designed by Selverstone, but it has the advantage of being much smaller, less complicated, and less costly to produce.

The various components of this clamp are held together by means of spring mechanisms; therefore, no special tools are needed to regulate blood flow (through the common or internal carotid artery), nor to detach the control assembly from the part to be left in the neck. Only a hemostat or similar instrument is needed to detach the lid (Fig. 2F).
The screw driver remains in the control assembly at all times, and its movements and position are controlled by means of the locking screw. In addition to moving the pressure plate, the screw driver is used to detach the clamp assembly. The cap makes it easy to push the control assembly through the stab wound; also, it protects the spring mechanism when the instrument is being stored.

**Application of Clamp A.** The pressure plate must be up against the lid before an attempt is made to remove the lid or attach it to the U-shaped clamp.

1. Expose artery in usual manner and make a small stab wound as shown in Fig. 1;
2. place clamp around artery;
3. push control assembly through stab wound far enough to clear cap, then remove cap which may be partially detached by forcing screw driver downward (after loosening locking screw);
4. attach control assembly to lid (snap on), then with finger under clamp for counterpressure place one flange in clamp and complete closure by gently forcing other flange into position (Fig. 2D);
5. under direct vision, using dot as indicator, note number of turns of screw driver required to bring about complete occlusion from any predetermined position of pressure plate;
6. to bring about additional occlusion, flush control assembly with alcohol, loosen locking screw fraction of a turn, turn screw driver (clockwise) as desired, tighten locking screw and re-apply dressing.

As the screw driver pushes the pressure plate down it assumes the same lower level as does the pressure plate; therefore, the position of the pressure plate can be determined by measuring the distance between the handle of the screw driver and the handle of the control assembly. When the artery is occluded the distance between the under surface of the screw driver (handle) and the top of the control assembly (handle) is approximately 8 mm., whereas when the pressure plate is completely retracted the distance is approximately 14 mm.

To remove control assembly from clamp and neck loosen locking screw; place two fingers under handle, and with thumb against screw driver force screw driver down as far as it will go. The pushing and pulling forces are equal; therefore, the clamp is detached without moving the artery.
When occlusion is brought about gradually over a period of several days, one or more turns of the screw driver than originally calculated may be required.

To avoid damage to the intima while the circulation is being tested, do not crush the vessel.

It is not uncommon for cerebral ischemia to manifest itself 48 hours or longer after closure of either the internal or common carotid artery; therefore, the control assembly should not be removed for at least 48 hours after complete occlusion of the artery.

*Maintenance of Instrument.* When properly matched a pull of $2\frac{1}{2}$–3 lbs. is required to separate the clamp from the control mechanism. A knowledge of the approximate resistance of the spring mechanism is soon acquired, and adjustments are easily made. If the spring mechanism is too weak, squeeze the lips together (with fingers) until a firm grasp is obtained.

When reasonable care is used the clamp can be spread more than enough to allow removal of the lid without affecting its resiliency. If bent its sides can be squeezed together (with fingers) until the original shape is restored.

**CLAMP B**

This clamp was designed to control blood flow through one or both internal carotid arteries at the level of the clinoids during exposure and treatment of aneurysms, thus eliminating the necessity of preliminary isolation of arteries in the neck; also for obliteration of the neck of certain aneurysms. It has served these purposes well, and proved its usefulness in other ways. The width of Clamp B is approximately the same as the length of the anterior communicating artery; therefore, it can be used to occlude some of the aneurysms arising from the anterior communicating artery (Fig. 3). Since the degree of occlusion can be controlled, and the clamp can be removed at will without damage to the blood vessel, it has been useful in controlling blood flow through the middle cerebral artery during exposure and treatment of aneurysms on that vessel.

In principle, Clamp B is similar to Clamp A, but it is a more delicate instrument. The grasp of the spring mechanism on the control assembly is much weaker ($1\frac{1}{2}$–$2\frac{1}{2}$ lbs.), and no locking screw is used. The shape of the clamp can be altered to meet various needs (Fig. 3, A and B). The small mushroom-shaped pressure plate moves on its pin; therefore, no torque is transmitted to the vessel when the screw driver is turned.

*Application of Clamp B.* A distinct advantage of this instrument over others is that because of its small size it does not interfere with stereoscopic vision which is extremely important to a surgeon trying to be precise in the application of a clamp at a great depth.

With one hand the surgeon guides the clamp to the desired position, then has his assistant...
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turn the screw driver to bring about the desired degree of occlusion. If the application is incorrect the procedure can be reversed and the clamp may be re-applied as many times as is necessary. If the clamp is to be left on a vessel it can be detached from the control assembly by placing two fingers under the handle of the control assembly for counterpressure and applying downward pressure on the screw driver.

*Maintenance of Instrument.* The spring mechanism on the control assembly was designed to withstand a pulling force of only $\frac{1}{2} - \frac{3}{4}$ lb. so that the clamp could be detached with a minimal force; therefore, the lips of the instrument are easily overstretched. Each time the instrument is used it should be checked, and, if necessary, the lips should be squeezed together (with fingers) until their holding effect is restored to normal.

These instruments are made by Mr. Fritz Linke and Mr. Phillipp Sommer in the Department of Physics of the University of Virginia, and are distributed by Codman and Shurtleff, Inc., Boston, Mass. and by V. Mueller & Co., Chicago.