

# New Treatment for Seborrhic Alopecia: The Ligature of the Arteries of the Scalp

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Bilateral ligature of the superficial temporal arteries and of the posterior auricular arteries is proposed as a treatment for seborrhic alopecia. The arterial circulatory dynamics are, thus, replaced by capillary circulatory dynamics. Hypoxia is produced which inhibits enzymatic systems and lessens nocuous action of androgen and lipid factors on the pilosebaceous effectors. The histologic study shows that the production of sebum is greatly reduced and the condition of the hair follicle is strikingly improved.

Clinically, of 1,300 surgical cases, observed for periods up to six years, 57 percent were cured, 19 percent improved, and 24 percent remained unchanged.

Seborrhic alopecia in young patients is a positive indication for the operation because it stops the evolution of the disease towards hippocratic baldness. The adult's alopecia bound to lipid or hormonal troubles is a secondary indication. The contraindication is constituted by the union of the following factors: (1) a hyperbeta-lipoproteinemia level exceeding 80 percent; (2) the appearance of seborrhia within 24 hours after washing the scalp; and (3) a high percentage of hair in the telogenic phase.

A 49-year-old female patient, treated since age seven with considerable doses of male hormones, presented with an abundant pilosity of her chest and a male pattern baldness, resulting from androgen toxicity (Figure 1). This patient was the "catalyst" for an approach to the improvement of seborrhic alopecia in men by a reduction of the arterial circulation which conveys androgens to the scalp. If we accept that the main androgen hormone active on the skin target cells is dihydrotestosterone, a metabolite of circulating testosterone, then the enzy-

matic control of the alpha-reduction of testosterone into dihydrotestosterone is assumed by the 5-alpha-reductase.<sup>1-8</sup> If this enzyme can be inhibited in the scalp, seborrhic alopecia will probably be reduced.<sup>9-15</sup> One of the most powerful non-toxic enzyme inhibitors is hypoxia.<sup>16</sup> Through surgery, by ligature of the scalp arteries, hypoxia can be induced in the scalp (by reducing the speed of the normal blood flow through replacing the arterial flow by capillaries and by obtaining a diminished PO<sub>2</sub> in the ligated area). By creating hypoxia in the scalp, testosterone metabolism will be reduced and the condition improved.<sup>17-19</sup>

Is it possible, without harm, to reduce the circulation of the scalp? In connection with seborrhic alopecia, the common opinion, although empirical, suggests that an abundant circulation in the vessels which feed the follicles must be maintained regularly.<sup>20</sup> Vasodilators, rubefacients, and physiotherapeutic methods combine to improve the hair's blood circulation. Thus, it is believed that any attempt to reduce the blood flow at this level would fail. On the contrary, however, instead of improving the situation, it should accelerate the loss of hair. Nevertheless, the surgical experiment shows that interruptions of the circulation in the scalp, as a result of traumatism or neurosurgical techniques, are without influence on

the state of the hair. No author mentions the appearance of evolutive alopecia as a result of hemostasis of the scalp. Moreover, temporal arteritis, a syndrome during which the circulation in the scalp arteries is greatly reduced if not totally stopped, is not accompanied by loss of hair.<sup>21</sup> It has been shown that homologous free grafting of a 3 to 5 mm diameter area, holding a few hairs with healthy follicles, is successful. Hair regrows although the grafts are implanted in a completely hairless region where the follicles are atretic.<sup>22-24</sup> Thus, it must be admitted that the bald regions of the scalp are sufficiently irrigated to ensure the growth of healthy hair.<sup>22</sup> One must conclude that alopecia depends on the bad health of follicles rather than an insufficient blood irrigation. This seems to confirm that hair loss is based on chemical and endocrine reasons. Since the reduction of blood circulation should reasonably do no harm to the patient, the operation may be attempted.

## *Blood Circulation of the Scalp*

Going from front to back and on both sides of the median surface, there are the frontal, superficial temporal, posterior auricular, and occipital vessels. This circulatory system is well branched with many anastomoses. This appears on angiographs of the scalp made on cadavers, but it is not the same in the living subject. The vasomotor action at the level of the capillaries isolates each arterial system of the scalp. Thus, when a dye is injected in the external carotid artery, where the superficial temporal has been previously ligated, the coloring spreads to the level of the face and the parietal and occipital regions, depending on the facial, auricular posterior, and occipital arteries. The dye does not penetrate in the area irrigated by the superficial temporal artery which

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Figure 1. Woman, 49-years-old, after seven years androgenous therapy (180 ml testosterone oenatate intramuscular, per week).

has been ligated and does not cross the median line. It is only a few hours later that the ligated area becomes colored as the rest of the body.

Like all the arteries of the skin, those of the scalp are terminal. When they are ligated, the arterial pulsations disappear and Doppler measurements are stopped. Consequently, how does the blood arrive in the ligated area? The blood of the neighboring regions penetrates the adjacent capillaries in order to establish a non-pulsed circulation in the ligated area.<sup>19</sup> The capillary blood arrives in the ligated area at a speed of .5 mm per sec, whereas, the arterial blood in the superficial artery flows at the speed of 10 cm per sec. Theoretically, it may be said that by replacing the arterial circulation at the level of the scalp, the speed of the blood is reduced 200 times. Therefore, the circulating androgens from the bordering capillaries will arrive in the ligated area about 200 times slower than normal. At the same time, the  $pO_2$  is reduced and the relative hypoxia established consequently inhibits the enzymatic system in the target cells.

From a surgical point of view, it is extremely interesting that all of the vessels do not have the same caliber, and consequently, the blood flow varies from one vessel to another. The superficial temporal artery is the most important artery of the scalp. The temporal pulse can very easily be palpated at the level of the zygomatic arch. The frontal and temporal branch may be readily followed to a certain level by palpation alone. Palpation of the pulse of the other arterial vessels is

difficult. For these, Doppler measurements are very helpful.

### Surgical Technique

In seborrheic alopecia, which vascular systems can be ligated to produce a reduction of blood flow? In principle, the diseased areas are those irrigated by the superficial temporal, posterior auricular, and occipital vessels. Bilateral ligation of the superficial temporal vessels has been made.

Under local anesthesia (3 ml of 2 percent xylocaine with adrenaline), a 3 cm vertical cutaneous incision is made in the temporal area above the zygomatic arch. The pilosity of the area will easily hide the scar in such a way that the operation gives full satisfaction.

The temporoparietal and frontal branch are bound separately after locating them on the skin by palpation of the pulse and by the previous injection of a drop of blue dye through the skin. Often, I have associated the ligation of the posterior auricular arteries to the ligation of the superficial temporal arteries. An incision in the auriculo-mastoidian line easily uncovers the posterior auricular artery, as it crosses the point of the mastoid. Ligation here is sometimes difficult. The scar is hidden behind the external ear.

I have operated on several hundred patients, ten percent of whom were women. Nevertheless, I have only been able to collect 1300 complete cases which were followed for variable periods, ranging from six months to six years. The other patients were examined closely immediately following the operation, and since they came from abroad have been lost to follow-up. These patients were not taken into consideration.

Sebum is borne by blood lipids and recaptured by the sebaceous glands. Lipemia in patients who have developed seborrheic alopecia is extremely important. Thus, the lipidogram shows a hyperbetalipoproteinemia even in very young patients. The serum cholesterol and uric acid levels are higher than normal.

### Results

Of the 1300 cases followed, 987 patients had very favorable results. Approximately 76 percent of cases revealed a reduction in hair shedding. A lengthening of the time necessary for the hair to become greasy (rare-

fying dandruff and reducing scalp itching) was also noted. Results are obtained at variable periods of time. Often, improvement of seborrhea comes before improvement of hair loss. Sometimes, it appears as soon as the 15th day; but usually, four to eight months are required before improvement reaches its maximum level or complete cure is obtained.

None of those who had surgery showed recurrence of the illness. Approximately 17 percent of cases showed a regrowth of hair at the bald regions. Twenty-four percent of patients having ligation of the arteries of the scalp showed no improvement in their seborrheic alopecia.

### Comment

It is possible to distinguish the clinical signs which prevent good results through the operation. These are patients whose hair becomes oily 12 to 18 hours after a shampoo and where a slight pulling of the hair causes a great number of them to become loose. These patients always show a distinct increase in blood lipids, an elevation of beta-lipoproteins, and a high Burnstein test. Therefore, lipemia has to be examined carefully by every possible means before deciding if it is advisable to operate.<sup>25-28</sup>

This surgical procedure aims to reduce blood irrigation of the scalp and is often compared with a technique which surgically liberates the epicranial aponeurosis. Authors claim this increases the circulatory flux at the level of the hair.<sup>29-33</sup> In reality, this operation is very bloody because many arterioles in the dermis of the scalp are cut. It creates a reduction and not an increase of the blood irrigation. Actually, the good results obtained through the incision of the epicranial aponeurosis are comparable to mine, because the technique produces the same circulatory result, restraining the conveyance of blood to the level of hair.

In conclusion, surgical reduction of blood irrigation of the scalp, replacing the arterial circulatory dynamics by capillary circulatory dynamics, is the rational and effective adjuvant of dermatologic treatment for seborrheic alopecia.

The proof of this statement is provided by the histologic studies which Gilbert Mimoune, MD (Paris) performed on biopsies of the scalp at

the time of operation and 12 months later from the same area (Figures 2 and 3). The epithelium is thin, flattened, and is covered with orthokerotic scales. The malpighian epithelium shows that its papillary pimples, short and thick-set before the operation, develop very deep in the dermis. The stratum granulosum thickens and the kerotic scales disappear. The collagenous tissue of the dermis becomes enriched with fibroblasts and is tighter. Before the operation it appeared hyalinized and cracked. The capillary system becomes clearly more abundant and open. Sectioning the arteries has also interrupted the periarterial sympathetic system, which can interfere with relative vasodilation. The hair sheath, poor in epithelial cells before the operation, becomes enriched with important young and thick cellular populations, increasing mitosis. The sebaceous glands, functioning abundantly before the operation, become reduced, less dense, and show spaces empty of all cellular elements. This signifies a necrobiosis devoid of lipid inclusions. These histologic images show that the circulatory slowing obtained by the arterial ligatures at the level of the scalp is a treatment of primary value in reducing the sebum production which improves the cellular life of the dermis, epidermis, and hair follicle.

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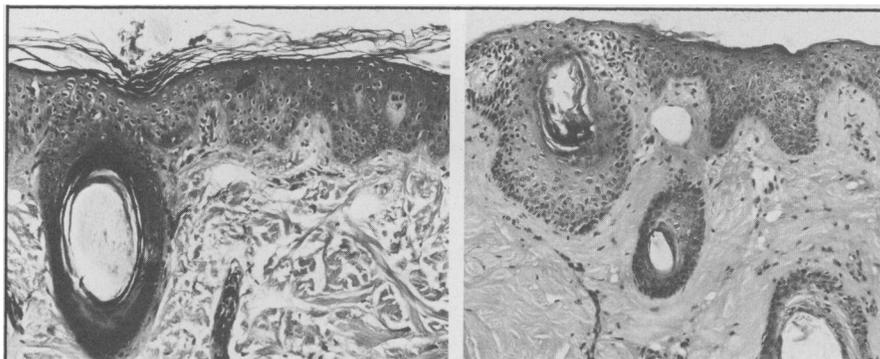


Figure 2. Histological aspect of the scalp before operation (left). Histological aspect of the scalp one year after operation (right).

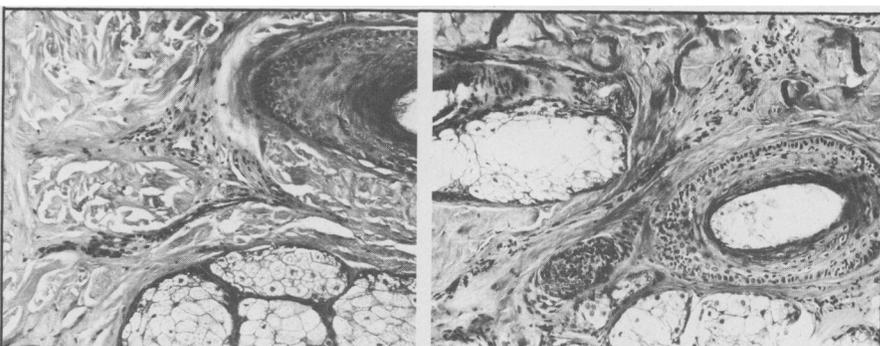


Figure 3. Sebaceous glands, dermis, hair follicle before operation (left). Sebaceous glands, dermis, hair follicle after operation (right).

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