Cocaine and Its Use in Ophthalmic and General Surgery

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Title: Cocaine and Its Use in Ophthalmic and General Surgery

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COCAINÉ

AND

ITS USE IN OPHTHALMIC AND
GENERAL SURGERY

BY

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CITY OF NEW YORK

Reprinted from the Archives of Ophthalmology, December, 1884

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NEW YORK & LONDON

G. P. PUTNAM'S SONS

The Knickerbocker Press

1885


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ON COCAINE AND ITS USE IN OPHTHALMIC
AND GENERAL SURGERY.

By H. KNAPP.

No modern remedy has been received by the profession
with such general enthusiasm, none has become so
rapidly popular, and scarcely any one has shown so extensive
a field of useful application as cocaine, the local anaesthetic
recently introduced by Dr. C. Koller, of Vienna. Convinced
that it will not only continue to prove as valuable as
it has hitherto been found, but that its properties will be
the subject of numerous scientific researches and clinical ob-
servations all over the globe for many years to come, I pur-
pose, as far as I am able, to collect in the following pages
what knowledge has thus far been acquired on this highly
interesting and important drug. To help the reader in
gathering information is, however, not the only object of
this paper; I would like it also to act as a stimulus for new
investigations. From this standpoint I consider a faithful,
unabridged translation of the original paper which Dr.
Koller read before the Medical Society of Vienna, and
1, 1884, not only as an acknowledgment of a debt of grati-
tude we all owe to him, but also as an appropriate
introduction to the present article. The paper is as fol-

**ON THE USE OF COCAINE TO ANÆSTHETIZE THE EYE.**

By Dr. KARL KOLLER, Assistant Physician to the General Hospital in Vienna.
(Translated by H. Knapp.)

I want to report on some experiments which I have
made in regard to anæsthetizing the eye. This is not my
first communication on this subject—a previous one, to secure priority, having been directed to the meeting of German oculists held at Heidelberg Sept. 15th and 16th of this year. Dr. Brettauer, of Trieste, was kind enough to deliver my paper to the Publishing Committee, and to exhibit before the Society my experiments, which have since been repeated and confirmed in different places of Germany.

It is generally known that cocaine, the alkaloid separated from the leaves of erythroxylon coca, in 1859, by Niemann, a pupil of Wöhler, possesses the remarkable property of rendering, on local application, the tip of the tongue anaesthetic. This property was discovered by Prof. Schroff, who first, in 1862, mentioned it before this Society. It is further known that cocaine, through the circulation, contracts the peripheric arteries, and it is known also that it dilates the pupil both through the circulation and on local application. From the foregoing it is evident that cocaine has been instilled into the eye in former years, but those phenomena have been overlooked which will be the subject of my present communication.

The internal application of cocaine, tried repeatedly, has always been abandoned again. In 1880 Dr. von Anrep published an elaborate experimental paper on cocaine, at the end of which he points out that its local anaesthetic action may become of importance. To us Viennese physicians cocaine has been prominently brought to our notice by the thorough compilation and the interesting therapeutic paper of my colleague at the General Hospital, Dr. Sigmund Freud. Starting from the supposition that a substance paralyzing the sensitive terminations of the mucous membrane of the tongue could not greatly differ in its action on the cornea and conjunctiva, I have made, in the laboratory of Prof. Stricker, a number of experiments on animals, of which, in brief, the following were the results obtained:

A few drops of a watery solution of muriate of cocaine;¹

² Centraltbl. f. Therapie u. Heilk., August number, 1884.
³ Muriate of cocaine dissolves up to 5 % in water without addition of an acid, but always opalescent. Addition of acids is to be avoided, as a very small quantity of acid causes intense burning. The opalescent solution becomes as clear as water by filtration.
dropped on the cornea of a guinea-pig, rabbit, or dog, or instilled into the conjunctival sac in the ordinary way, cause for a short time winking of the eyelids, evidently in consequence of a slight irritation. After one half to one minute the animal again opens its eyes, which gradually assume a staring look. If now the cornea is touched with a pin-head (in which experiment we have carefully to avoid touching the eyelashes), the lids are not closed by reflex, the eyeball does not move, the head is not drawn back as usual, the animal remains perfectly quiet, and on application of stronger irritation we can convince ourselves of the complete anaesthesia of the cornea and conjunctiva. In this way I have scratched and transfixed the cornea of my animals used for experiment with needles, and have excited them with electric currents so strong as to cause pain in my fingers and become quite intolerable in the tongue; I have cauterized the cornea with the nitrate-of-silver stick until it became milky-white—during all this the animals did not move. The last experiment convinced me that the anaesthesia involved the whole thickness of the cornea, and did not affect the surface only. But if I incised the cornea, the animals manifested intense pain when the aqueous humor escaped and the iris prolapsed. I have been unable, hitherto, to decide by experiments on animals whether or not the iris could be anaesthetized by dropping the solution into the corneal wound, or by prolonged instillations into the conjunctival sac; for experiments to test the sensibility of non-narcotized animals are very complicated and difficult, and do not yield unambiguous results. The last question which I subjected to experimentation on animals, viz., whether or not the inflamed cornea could be anaesthetized by cocaine, was answered in the affirmative. The cornea in which I had incited a foreign-body keratitis became as insensible as a healthy one.

Complete anaesthesia of the cornea from the use of a 2% solution lasts ten minutes on an average. After such successful experiments on animals I did not hesitate to apply cocaine also to the human eye, trying it first on myself and some of my friends, then on a great number of other
persons, obtaining without exception the result of a perfect
anaesthesia of the cornea and conjunctiva. The course of
the phenomena is as follows: If some drops of a 2% solution
are instilled into the conjunctival sac, or better still, let run
over the cornea, first a slight burning (accompanied by some
lachrymation) is felt, which in one half to one minute disap-
pears, being followed by a dull sensation of dryness. The eye,
like that of the animals mentioned above, assumes a staring
look, owing to a considerable dilatation of the palpebral
fissure, a phenomenon to the explanation of which I shall
return later on. If now the cornea is touched with the head
of a pin, no sensation of pain, or of contact is experienced,
and all reflexes are absent. The same holds of the con-
junctiva, in which the sensation of temperature is likewise
abolished. The scleral conjunctiva can be grasped with a
pair of toothed forceps, or a dimple can be made into the
cornea by pressure, without any unpleasant sensation or the
least reflex on the part of the person thus treated; the only
thing he perceives is an indistinctness of objects, owing, of
course, to the change in the curvature of the cornea. This
complete anaesthesia lasts from seven to ten minutes, then
passes through a longer stage of reduced sensibility into the
normal condition. About fifteen or twenty minutes after
the instillation the pupil begins to dilate. The dilatation
reaches its highest degree within the first hour, decreases
considerably in the second hour, and disappears without a
trace in a few hours more. The pupil is never ad maximum
dilated, responds promptly to light and convergence during
the whole time, and for that reason the sensation of daz-
zling, connected with atropine mydriasis, is either totally
absent or only slightly pronounced.

A very insignificant paresis of accommodation appears
and disappears with the mydriasis; the near point receded
\( \frac{1}{2} \)" in myself and another person whom I examined on this
point.

Furthermore I have observed a marked ischemia in the
normal, especially the palpebral, conjunctiva, on the dura-
tion of which I am unable to make any definite statement.
Other not perfectly ascertained observations, such, for in-
Cocaine in Ophthalmic and General Surgery.

stance, as the ophthalmoscopic condition, I will pass by for
the present, yet I want to say that I have never noticed
any symptoms of irritation from the use of cocaine.

As to the dilatation of the palpebral fissure, this phenome-
non at all events precedes the action of cocaine on the
muscles of the iris and the ciliary ligament. On account of
its almost simultaneous occurrence with the anaesthesia of
the cornea and conjunctiva, I have thought it to be in con-
nection with this anaesthesia, accounting for it by the omis-
sion of the excitations which in the normal state act upon
cornea and conjunctiva, and upon which the ordinary width
of the palpebral fissure depends.

In regard to the anaesthesia I should not omit to mention
some points of practical interest.

1. The anaesthetic effect of cocaine may be cumulated up
to a certain limit, namely: if at the decrease of the anaes-
thesia cocaine is instilled anew, a second anaesthesia is obtained
lasting longer than the first. In this way, by instillations
every five minutes for a longer time, I have produced com-
plete anaesthesia of from fifteen to twenty minutes duration.

2. The anaesthesia is chiefly a local one, i.e., it is most in-
tense in those places which have been in contact with the
solution directly and longest.

3. As it can be demonstrated that cocaine is absorbed, and
that from each instillation a certain, though small, quantity
penetrates into the interior of the eye, first of all into the
anterior chamber, it could a priori be expected that the
deeper structures of the eye might be anaesthetized if they
could be reached by sufficient quantities of the remedy.
But as the absorption requires a certain time, and the an-
aesthesia of the cornea is of short duration, the anaesthesia of the cornea will have disappeared before the iris and
ciliary body are acted upon. We must therefore anaesthe-
tize the cornea again. Both demands can be satisfied by
successive applications. By instillations of a 5% solution
made every five minutes and continued for about half an hour,
I have succeeded in ascertaining an action upon the deeper
parts of the globe, inasmuch as its sensibility on stronger
pressure was essentially diminished.
I am indebted to the liberality of Dr. v. Reuss, acting surgeon of the clinic of the late Professor v. Jäger, for the opportunity of testing, during the last two or three weeks, the action of cocaine on diseased eyes.

From the beginning I have thought that therapeutically cocaine might be used in two directions: first, as a narcotic in painful affections, of the eye, and secondly, as an anaesthetic in operations on the eye.

In regard to the first category I have expected a good deal of benefit from its action in diseases of the cornea and conjunctiva accompanied by pain and photophobia. I have used cocaine in a greater number of patients suffering from lymphatic (phlyctenular) conjunctivitis with eruptions and ulcers of the cornea, and a 2% solution in one patient affected with frenulum vasculare (from successive phlyctenulæ). All patients thus treated have said that a few minutes after the instillations they have felt materially better, pain and photophobia having considerably diminished. With the same unanimity, however, they have complained that two or three hours after the instillation pain and photophobia have returned. It might therefore be expected that by applications repeated at such intervals pain and photophobia could permanently be removed or at least abated. This mode of application has not yet been tried. Under the conditions to which I have limited my experiments I have not noticed any influence on morbid processes either in the one or the other direction.

With similar result I have used cocaine in a man with painful erosion at the sclero-corneal junction.

I should think that cocaine might exert its influence also on the pain in iritis, for I believe to have demonstrated that its anaesthetic effect extends in a certain degree to the iris and ciliary body. The mydriatic effect, on account of its insignificance, would not merit great consideration, but we may expect some influence from its property of contracting the blood-vessels. The combination with atropine treatment may, perhaps, be of advantage. I have not yet had an opportunity to try it in this disease.

The sensation of pain from cauterizing the lids with ni-