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**ON THE MINIMIZING OF HÆMORRHAGE IN EXTIRPATION
OF THE TONSILS AND ON THE EMPLOYMENT OF THE
HÆMOSTATIC GUILLOTINE.¹**

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[*Abridged.*]

WE must first of all make a short digression in order to define terms. The extirpation of a tonsil by whatever method, whether by dissection, by the guillotine, by the snare, by the finger, or by punches, etc., may be either *partial* or *total*. The latter, when the whole tonsil, including the parenchyma and the capsule, is removed entire in one mass, like a nut, is known as *enucleation*. Some laryngologists and general surgeons use the term *enucleation* as synonymous with total removal of a tonsil, even if it is extirpated in two or more portions, but such nomenclature is not strictly accurate. An *enucleation* was doubtless sometimes effected by the finger method alluded to by Celsus. It was often, however, a very sanguinary operation, in spite of assertions to the contrary, and

¹ Read at the meeting of the British Medical Association, Aberdeen, July, 1914.

was usually followed by much pain and inflammatory reaction. The guillotine operations of the last century, like the dissecting operations with vulsellum and scalpel or scissors, were for the most part incomplete or partial extirpations. The *normal partial* operation which was the one usually aimed at consisted of the reduction of the enlarged tonsil to about its normal size, so that the part left behind did not project beyond the pillars. A more partial operation which from want of skill leaves a good deal of tonsillar tissue projecting beyond the level of the pillars, may be designated an *insufficient partial* operation. Between what we have called the normal partial extirpation and total removal (whether the latter is *en masse*, *i. e.* enucleation, or in two or more portions) there is an intermediate operation which may be designated *subtotal*—that is, very nearly total extirpation—in which almost all the parenchyma is removed, but the embedded part of the capsule lining the tonsillar bed is left behind.

On account of occasional recurrence of the enlargement, more especially in children, when the partial operation merely reduced the tonsil to more or less normal dimensions, total excision—and preferably in the form of enucleation—is now aimed at by many experts. The subtotal operation, called in America Myles' operation, is, however, held by some to be the ideal operation. There is usually less inflammatory reaction than after total removal, and the preserved capsular lining to the tonsillar bed prevents exposure of the peritonsillar lymphatics, and tends to reduce the chances of local septic infection. While, however, a total extirpation requires more skill in its successful performance than a "normal partial" one, the subtotal operation is extremely difficult to carry out with regularity and precision either with the guillotine alone or with the snare, and portions of parenchyma left behind have often to be punched out to complete the operation; the authors have in the past used Kretschmann's punch for this latter purpose. The tendency at the present day in this country and in America, however, is to aim at total extirpation, whatever instrumental method is employed. Partial reduction to the normal size, however, appears to be still popular on the Continent and has some advocates here and even in the United States. A leading American authority on the tonsils, Makuen, has recently re-affirmed his preference for either subtotal or partial removal on the ground that total removal of the capsule as well as the parenchyma leads to deformity of the fauces and vocal deterioration, and is unjustified in singers especially. Those who usually aim at total extirpation

in the general run of cases are agreed that the partial operation is preferable in professional singers.

Curiously enough discussions on the relative merits of "normal partial," of subtotal, and of total extirpations respectively of the faucial tonsils have usually taken place under the inappropriate heading of "*Tonsillotomy versus Tonsillectomy*." These terms are by no means synonymous or even suggestive of partial excisions on the one hand, and total on the other. The term tonsillotomy may be rightly applied to the operation of slitting up a chronically septic crypt or making an incision to facilitate the extraction of a calculus of the gland. The parallel term, gastrotomy, suggests an incision into the stomach, but not either a total or a partial gastrectomy. No one would understand by thyroidectomy a total excision of the thyroid gland, as such an operation is contra-indicated. It must be obvious that the term tonsillectomy implies equally either a partial or a total extirpation of the tonsil by means of a cutting operation and not necessarily with the guillotine; and that the term cannot very appropriately be applied to total extirpations with the finger or with the snare.

On account of the old form of guillotine operation proving inadequate in many cases for the complete removal of tonsils, a return to the method of completely dissecting out the tonsil with vulsellum and scalpel or dissector was strongly advocated early in this century by Waugh, Hey Groves and other general surgeons in this country, in order to reduce the number of recurrent cases amongst children operated on in the out-patient department of hospitals. The same more thorough, though sanguinary, procedure became prevalent about the same time in the United States, though there blunt dissectors and special scissors were often used either with or without the aid of the knife.

The operation described so accurately by Waugh was an improvement on the old scalpel operation, as the pillars were carefully dissected so as to expose the capsule, which was freed from the bed of the tonsil by means of the finger, with or without the further assistance of the knife, snare, or guillotine.

The employment of the snare as an adjunct to the dissecting operation was much used in the United States, and this led to the revival of the snare operation, either alone in suitable cases, or in conjunction with dissection in broad-based adherent and buried cases for the enucleation of tonsils. Tilley and Waggett, among British laryngologists, have, in the past at all events, been warm advocates of the use of the snare. The snare usually employed

both here and in America is a different instrument from that employed by Lennox Browne and was the invention of an American surgeon, Eve. The instrument is a straight one, and the loop is of No. 8 piano wire, and the tonsil in suitable cases can, in practised hands, be enucleated and detached by hand-traction only. This operation, with snare alone, is usually a much less hæmorrhagic one than the ordinary sharp guillotine operation, and of course very much less so than when any considerable dissection is resorted to. The disadvantages of the snare and vulsellum method are that it is more difficult to carry out than the guillotine operation, requiring, as it does, considerable experience, added to natural expertness; and, on account of the pliability of the loop, it is not always possible to do a clean enucleation without preliminary dissection, which latter considerably reduces its hæmostatic value. Leslie Davis, of Philadelphia, who performs enucleation by means of dissection combined with the snare, actually advocates *routine ligation* of a group of vessels in the upper part of the eviscerated tonsillar bed by passing a silk suture on a curved needle by means of a special needle holder underneath this vascular bunch and then tying the suture. Most operators, however, only resort to ligature when serious bleeding ensues, and it is unlikely that its adoption as a routine precautionary measure will find much favour.

During the last three or four years many of those who formerly relied on (1) dissection, either alone or combined with the guillotine or snare, or on (2) the snare with or without preliminary dissection, have come back to the pure guillotine method. The recently developed guillotine operation is, however, a very different one from the old sharp-bladed method, in which enucleation could only be effected with certainty in a moiety of favourable cases.

In order to contrast the new and the old method of operating with the Physick type of guillotine, it is necessary for us to make another digression, and again for the purpose of defining terms, in order to facilitate lucidity of description. All modifications of Physick's guillotine present for examination two main portions, viz. a haft and a shaft. The haft or handle in Mackenzie's, Heath's, Kelson's, Jones' and other guillotines is a more or less plain straight bar, which is attached more or less at right angles to the shaft by a screw arrangement. In Ballenger's model the handle is more complicated and serves the additional purpose of driving home by lever action the knife blade, which is pushed home by the thumb in the older pattern. The *shaft* of a guillotine is made up of a steel *bed* for the sliding *blade*, which latter has a crescent-

tic sharp cutting edge distally. The hole, or *fenestra*, at the distal end of the shaft is usually loosely alluded to as the "ring" of the guillotine. The accessory arrangements for keeping the sliding blade in its bed differ in the various designs. It is incorrect to speak of the composite shaft as the *blade* of the guillotine.

If the guillotine be held with its handle vertical and shaft horizontal, the latter will present two flat horizontal surfaces, one looking downwards, *i. e.* handlewards, and the other upwards, or ob-handlewards. It will save a good deal of confusion if we speak of these two surfaces of the shaft as the handleward and ob-handleward surfaces respectively, rather than as upper and lower, or inner and

The Elphick hæmostatic guillotine.

outer, as is usually done. The modern type of shaft differs from the Physick type in that the former is strengthened or reinforced by being made of much thicker steel, so that it cannot bend when used as a lever, as presently to be described. Sluder's reinforced shaft, fitted to a Ballenger handle, may be taken as embodying the most recent improvements in guillotine construction. The edge of the blade, however, instead of being as sharp as possible, as in the older guillotine method, is used either dulled or actually blunt.

It may appear superfluous for us to contrast in detail the technique of the old with more modern methods of extirpation with the Physick type of guillotine, but the necessity will be obvious later. When the old operation was performed, for example, on the *left* tonsil, with the patient in the upright position, the shaft was inserted flat along the surface of the tongue, the handle being vertical, the distal extremity of the shaft was then depressed, so

that the lower pole of the tonsil could be somewhat engaged in the fenestra, the shaft was then rotated through 90° , so that the handle projected horizontally to the left from the corresponding angle of the mouth; the handleward surface of the shaft thus looked laterally to the left, and was distally in contact with the left faucial surface, and proximally was against the left corner of the mouth, the whole of the shaft being in the sagittal plane; by digital pressure inwards and upwards from the outside at the angle of the jaw aided by outward pressure of the guillotine, as much of the tonsil as possible was forced through the somewhat undersized fenestra, and the blade was then driven home. If the blade was very sharp, either the whole or a greater or less portion of the tonsil was detached from the fauces and either hung by a few threads of the tissue at the end of the shaft or else fell off into the buccal cavity or into the pharynx; by a scoop-like action of the guillotine, the tonsil, when completely detached, was retrieved, aided perhaps by the finger; in some cases it was swallowed. When the edge of the blade was blunt, the instrument was often "held" in the fauces and had to be detached either by traction or the use of the finger or both combined.

For very many years, however, a modification of this old procedure has been practised; after more or less of the tonsil was engaged in the hole of the guillotine, the proximal end of the shaft was moved from the left angle of the mouth horizontally across towards the opposite angle, so that the direction of the axis of the shaft, instead of passing sagittally backwards as in the early method, occupied a more diagonal position directed through the buccal cavity. At the same time the shaft was rotated somewhat, through its long axis, so that its handleward surface looked slightly upwards and forwards to the left. In addition, the distal end of the shaft was drawn slightly forwards, dragging the tonsil (which is loosely attached to its bed) and displacing the posterior pillar slightly forwards and upwards and bulging the anterior pillar forwards, inwards and upwards; the blade was then driven home either by the thumb of the hand grasping the handle, or by that of the other hand. It should be stated that the advantage of using a blade with not too keen an edge, or even a blunt one, was pointed out in a discussion at the London meeting of the Association in 1910. By this means experts succeeded in a large proportion of cases—in children especially—in effecting either a total extirpation (enucleation) or else a subtotal one. It is curious that, though this modification has been practised for many years by some experts, none of

the modern text-books, so far as we are aware, lay any stress on it, with one exception. StClair Thomson not only describes it, but gives an explanatory diagrammatic illustration of the manoeuvre; he appears, however, to make use of traction with a vulsellum as an adjunct in some cases. This operation was performed either with Mackenzie's or Heath's, or some other modification of the Physick type of guillotine.

Within the last four or five years the technique of enucleation with the guillotine has been further modified and undoubtedly improved by Whillis in this country, who wrote in collaboration with Pybus, and by Sluder in America. The two methods are often assumed to be identical, but the description of each which follows will, we feel confident, show that this assumption cannot be maintained. Whillis and Pybus can claim priority of announcement—January, 1910, against June, 1910. Both methods are based broadly on the later technique we have just dealt with above, as performed with the old guillotine, which improved method, as we have pointed out, was so clearly described and illustrated by StClair Thomson.

First as to the form of guillotine used. Whillis, in Newcastle, and Sluder, in America, independently decided that it was necessary to strengthen considerably the shaft of the guillotine in order that, when this was used to forcibly lever the tonsil upwards and forwards from its normal bed, the shaft should not bend and so impede the action of the sliding blade, as was sometimes experienced with the old type of instrument. Moreover Whillis, like Sluder, independently arrived at the conclusion that in dealing with the tonsil (and we will here again consider the *left* tonsil) it was of advantage to apply the ob-handleward surface of the shaft to the faucial region and not the handleward surface, as in the modified old operation; and necessarily the handle of the instrument, instead of projecting towards the left and forwards, pointed towards the *right shoulder*, the proximal end of the shaft pressing backwards the right angle of the mouth; and the direction of the long axis of the shaft thus more nearly approached to a transverse rather than a diagonal line through the buccal cavity. Sluder, after threading as much as possible of the tonsil, commencing at the lower pole through the fenestra of the guillotine, then levered the tonsil and the attached posterior pillar upwards and forwards, so that the semicircular distal border of the shaft abutted against the dental eminence on the inner surface of the mandible, corresponding to the position of the fangs of the last molar tooth; with

this eminence as a *point d'appui* the dull or blunted blade was driven home, passing behind the anterior pillar over the deep surface of the capsule, without cutting it, towards the posterior pillar; which latter the previous manœuvre had displaced as far as its tonsillar attachment was concerned, forwards and outwards, so as to lie almost in the same coronal plane as the anterior pillar, though of course considerably external to it. The resistance of the anterior pillar associated with this forward, upward and rotatory displacement of the gland caused most of the tonsil to pass through the fenestra, and the pressure of the advancing dulled edge blade compressed the whole gland through the fenestra; the tonsil was therefore entirely dislocated out of its bed with which it was connected merely by a compressed stump. This latter is necessarily composed of the circumferential reflection of mucosa, connecting the equatorial area of the tonsil (at the junction of its embedded and non-embedded portions) together with some areolar tissue and vessels of the tonsillar bed. The method is difficult and not always successful as regards enucleation.

The manœuvre as described by Whillis and Pybus is somewhat similar, but not by any means identical with that of Sluder; they make no effort to bring the end of the shaft of the guillotine against the dental eminence, which is an essential part of Sluder's method, as originally described by him; on the contrary they lever the tonsil and posterior pillar forwards and upwards to a position far removed from and above the dental eminence of Sluder, producing a marked bulging of the anterior pillar of the fauces somewhat high up, and before driving home the dull-edged blade they insinuate the whole of the tonsil through the fenestra of the guillotine by means of digital coaxing, combined with firm compression on the anterior pillar. This manipulation with the finger or thumb is an essential original feature in the technique of Whillis and Pybus.

It seems to us clear that the operation now usually performed in this country and rather frequently designated "Sluder's method," should really be described as that of Whillis and Pybus, or shortly "Whillis' method," as Whillis we have reason to conclude was actually responsible for the improved technique subsequently so clearly described and illustrated by him and his collaborator Pybus. Although we prefer the technique of Whillis as the easier and more certain as an enucleating procedure, yet from the point of view of hæmorrhage there is little to choose between the two

methods. They both possess the disadvantage attaching to the use of a blade with an edge which is not keen, viz. that the crushed stump cannot easily be severed without considerable pressure, and that forcible traction or else *torsion* has at times to be resorted to, which means tearing through the stump at a level deeper than its crushed portion, thus leading in some cases to considerable bleeding. Sluder has recognised this disadvantage and endeavours to crush right through the stump by an added mechanical arrangement, exerting much additional pressure at the proximal end of the blade. O'Malley, who has made several modifications in the Ballenger-Sluder instrument, has endeavoured to facilitate the crushing through and severance of the stump by ingeniously filling up the usual slot of the ring with lead into which the dulled edge of the blade sinks. He uses a blade the edge of which is only slightly dulled and considerably sharper than that employed by many operators, and he claims to carry out thorough enucleation and easy severance of the stump without necessitating straight traction, but rather indirect traction, but by means of a half turn torsion following Whillis, and he further claims with the loss of only two or three drachms of blood.

It is important to bear in mind the fact that up to the time of the driving home of the dull blade, the modern guillotine method of enucleation of the tonsil is a hæmostatic one. If the guillotine remains held after driving the blade well home the stump has to be torn through deep to the crushed portion, and the operation is apt to be converted into a very sanguinary one. A single blade obviously cannot perform the two functions of crushing and cutting; if too sharp it is apt to cut through the capsule and embedded part of the parenchyma in a certain number of cases, and if blunt it crushes the stump without severing it, and then either traction or torsion must be employed; in either case there may result considerable, and at times severe, hæmorrhage.

No doubt the idea of incorporating a blunt crushing blade as well as a sharp cutting blade lying side by side in the same shaft of the guillotine has occurred to some others, but when this was designed by one of us in November of last year, neither of us was aware that any such suggestion had ever been made by anyone previously.

As will be seen by referring to the illustration, the Elphick Hæmostatic Guillotine is in general construction on the lines of the Ballenger-Sluder instrument. The blunt-edged crushing blade is situated on the surface of the shaft which looks away from the

handle, the ob-handleward one, and is driven home as in the Ballenger instrument by handle action. There is, however, an added catch arrangement to retain the crushing blade hard against the stump for so long as may be deemed expedient. The crescentic edge of the blunt crushing blade is either smooth or else serrated; our preference is for the latter. The sharp cutting blade is placed in a plane nearer the handle than the crushing blade, but parallel to it, and is driven home by the disengaged hand; it resembles the blade of the Physick type of instrument in shape and mode of action. The instrument is manipulated according to the Whillis method as far as the stage of manipulating and then everting the tonsil by digital pressure well through the hole of the guillotine; the crushing blade is then driven home, and the tonsil is now isolated and connected with its bed only by the narrow stump (crescentic on section) which lies crushed between the opposing surfaces of the crushing blade and the distal rim of the fenestra. The shaft of the guillotine is now made to assume a more sagittal direction, and the tonsil is seized with a vulsellum; the cutting blade is then driven home and the entire gland, including its inverted capsule, detached. The stump, however, is still clamped by the crushing blade.

Up to this stage there is either no hæmorrhage at all or else a mere trace of blood in the faucial region. As the normal coagulation time of the blood is about five minutes, the instrument is allowed to remain at rest in this position attached to the fauces for five or six minutes, if practically perfect hæmostasis is desired. The catch holding the crushing blade in contact with the compressed stump is then, after a suitable delay, released and the instrument withdrawn. The bleeding from the bed from which the tonsil has been enucleated is so slight as to amount almost to a mere smear of blood. The remaining tonsil is dealt with in the same way. To avoid the prolongation of the time during which the anæsthetic has to be administered, the second tonsil can be dealt with by another guillotine, whilst the first guillotine still clamps the stump, provided the mouth and buccal cavity is sufficiently large to permit of the necessary manipulations with the second instrument in spite of the presence of the first one.

In the case of hæmophilics the coagulation time should be ascertained and, if possible, reduced by the administration of horse serum, calcium lactate, etc., and if the coagulation time is reduced from say fifteen minutes to eight minutes, it is obvious that the tonsillar stumps must be each compressed for nine or ten minutes.

To make sure not only that there shall be no primary bleeding, but as a safeguard against secondary hæmorrhage, the stump can be ligatured distally to the crushed portion before releasing the clamp by a silk thread passed round the stump between the end of the shaft and the tonsillar bed. This effectually prevents the gaping of the stump which otherwise occurs on unclamping.

It will be evident that this hæmostatic enucleation manoeuvre is rather a protracted method, and can only be carried out under somewhat prolonged general anæsthesia; it is, therefore, only indicated in cases of hæmophilia and in debilitated anæmic subjects in whom even a moderate loss of blood is of some moment. For the ordinary run of hospital cases in which guillotine enucleation is performed under short anæsthesia, in either the upright or the supine position, it is neither possible nor usually necessary to make any pause between the cutting off of the tonsil and unclamping the stump; but we can assert that the amount of bleeding from the bed of the tonsil is comparatively trifling in the majority of cases operated on rapidly compared with the average amount after the employment of present day patterns of one-bladed guillotines. In private practice where more prolonged anæsthesia by chloroform or by a mixture is adopted, our practice is to clamp each stump for one or two minutes, unless there are special indications for the more protracted compression—and the amount of bleeding is usually insignificant. We practise ourselves and, therefore, advocate in all cases the routine use of this type of guillotine which detaches the tonsil without disturbing the crushed stump and considerably reduces the average amount of blood lost, and which is in accordance with hæmostatic procedures carried out elsewhere by general surgeons.

The arrest of bleeding immediately following the removal of enlargement of Luschka's tonsil ("adenoids") can easily be carried out if specially indicated, by packing the post-nasal space with a firm moored pad of cotton-wool or of lint, or of gauze wrung out of boric acid lotion inserted by the aid of adenoid forceps and pressed well home with the finger. Hitherto, however, there has usually been a considerable amount of blood lost after removal of the tonsils and in some exceptional cases the bleeding has continued for so long as to necessitate the resort to exceptional measures such as long-continued pressure or the use of special forceps with one blade in the fauces and the other outside against the angle of the jaw, or sewing up the pillars with or without the adjunct of a roll of lint, or the use of Michel's clips, or the ligature

of separate bleeding points, and even tying the carotid, etc. All these procedures are a source of embarrassment to the surgeon and to the patient, whether done for primary or for secondary hæmorrhage, and in restless children already weakened by loss of blood the further administration of an anæsthetic becomes a necessary evil. Our object, therefore, should be to reduce the chances of such contingencies to a minimum, and hence the importance of the method we adopt and now for the first time brought to the notice of practitioners by us. The advantages of this instrument have been proved by many months' employment by ourselves and by our colleagues in the Throat Department of St. Mary's Hospital.

Quite recently one of us came across in the January number of *The Laryngoscope* for the current year, an article by Dr. La Force, of Iowa, entitled "La Force Hæmostat Tonsillectome." The instrument is of the Ballenger-Sluder type and is not only provided with both a crushing and a cutting blade (thus anticipating in principle the instrument we have employed), but also had as a component part an ingenious ligature-carrier by which the stump can be ligatured in three sections. This would effectually prevent the gaping of the stump which invariably follows unless ligaturing is resorted to; and is an improvement on the single thick silk ligature previously suggested by us in this article. The instrument is a complicated one, as is also the technique of its employment when ligaturing is carried out, but it is obviously theoretically the most efficient hæmostatic guillotine as yet devised; though the number of cases in which the tedious process of tying the stump in sections is indicated is necessarily small.

We have also ascertained that Mr. Howarth has recently made use of a Ballenger-Sluder type of guillotine with a dull-edged blade and a sharp-edged blade combined in one shaft.

[NOTE.—Dr. Hill wishes it to be understood that though he has borne a considerably larger share than his collaborator in the compilation of this article, yet any credit which may be considered due for the independent inception and details of construction of the hæmostatic guillotine here illustrated belongs entirely to Dr. Elphick.]

DIFFICULTIES AND DANGERS OF EXPLORATORY PUNCTURE OF THE ANTRUM OF HIGHMORE.¹

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EXPLORATORY puncture followed by perflation and irrigation is the most reliable method of diagnosing antral suppuration and is, therefore, in daily use in rhinological clinics.

¹ Read at the meeting of the British Medical Association, Aberdeen, July, 1914.