

CORNELIUS CELSUS AND THE TREATMENT OF FISTULA IN ANO A Surprise and a conundrum.

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The Roman author, Aulus Cornelius Celsus, wrote *de Medicina* during the first century CE.¹ In this book he describes some 120 surgical procedures, all of which are interesting but his treatment of a somewhat unpleasant, but not uncommon condition, called fistula in ano, presents first a surprise and then a conundrum.

By searching through earlier medical literature an explanation for the conundrum can be found and this will be presented later. First it is necessary to describe what a fistula in ano is, how it arises, why it is such an inconvenience, the possible treatments and the need for great surgical care.

Surrounding the lining, called mucosa, of the lower rectum and anus is a complicated sleeve of muscle, which is called the sphincter ani.² This complex muscle is small, about 3 cm high and 5-12 mm thick forming an annulus. This muscle when contracted, as it is most of the time, usually prevents the passage of flatus, fluids and faeces and these things are voided when the muscle is relaxed. As may be imagined the functional integrity of this sphincter muscle is socially very important.

There are a number of glands opening onto the lining of the lower rectum and anus. If the mouth of one of these glands becomes blocked, the gland becomes infected and an abscess results. The abscess may burst into the anal canal, but the abscesses of interest to both Celsus and many modern surgeons are those which arise in anal glands extending deep into the muscles. These abscesses instead of bursting painfully, but harmlessly into the anus, spread out between the muscle layers, come to a head, and then bursting through the skin near the anus. This is best understood by referring to a diagram (Figure 1).

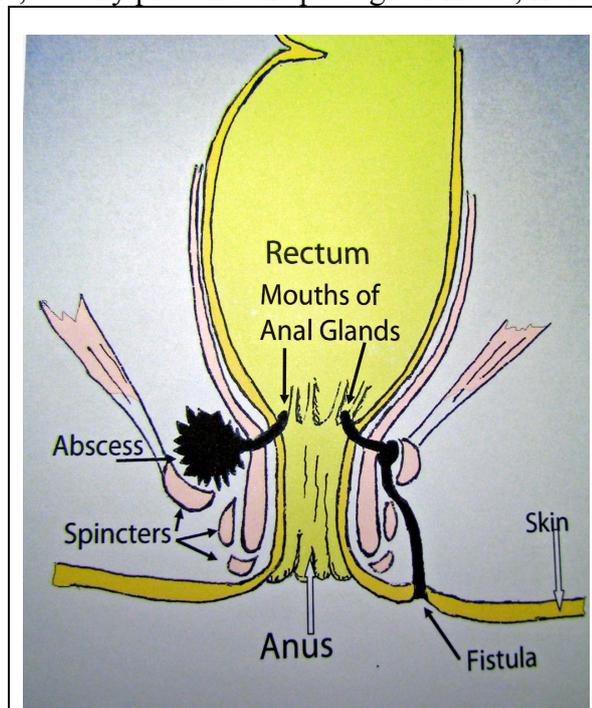


Figure 1. Diagram demonstrating the development of a fistula in ano from an intermuscular anal gland infection.

An abscess arising in an anal gland, once it has discharged through the skin, begins to heal and the mouth of the gland becomes open again. There is then an open passage from the mouth of the gland in the lower rectum extending to the skin near the anus. The amount of control that the patient has over how much pus and effluvia

¹ The text used is that found in the Loeb edition, which in turn is based on the Teubner version edited by F. Marx (1915): *Celsus de Medicina*, trans. W.G. Spencer, (1938) Loeb Editions, edited by Jeffery Henderson. Cambridge MA: Harvard Univ. Press,.

² For a comprehensible description of the surgical anatomy and surgery of the ano-rectum, its sphincters and fistulae see Rains and Capper (1968) 975-76 and 1003-10.

escape through this open passage depends on the depth of muscle which surrounds this passage. This septic passage can now be graced with the Latin and English name of *fistula* and in Classical Greek the name is, σῦριγξ. Sometimes, if the fistula extends completely outside the muscles there is no control and in extreme cases faeces escape continuously; in better conditions solids may be controlled but not always liquids and gas; in all cases there will be damp, smelly, secretions from the fistula itself.

Many modern surgeons will now, using painstaking dissection, cut out the fistula, meticulously repairing the divided muscle.³ It is a long and careful operation requiring excellent anaesthesia. If the sphincter muscle is not properly repaired, or if the repair breaks down because of infection or because of surgical incompetence, worse incontinence results.

There is another method of healing a fistula which is still used quite frequently, particularly in patients who present an anaesthetic risk. This second method is much simpler and in some hands much less likely to result in faecal incontinence but does take longer to resolve. This second method is the same as that described by Celsus two thousand years ago, except that Celsus used a loop of linen thread, or more probably linen string, whereas modern surgeons tend to use nylon tape which does not rot. The tape is called a seton, so it is called ‘the seton method’.⁴ Celsus’ method and the ‘seton method’ are often referred to, for the purposes of this paper, as ‘the loop of string method’.

The results of modern treatment are disappointing in many patients. In one recent systemic review of published papers the post intervention incontinence rates were 5.6% in those patients who had a seton placed and 25.2% in those who had surgical division of the sphincter at the time of placement of the seton.⁵ In another report, prolonged pain was a principal drawback to the use of a tight seton as Celsus had predicted.⁶

Celsus’ instructions to his trainees are clear and precise and are quoted below in the English translation by Spencer from the Loeb edition of *De Medicina*, book 7.4.4A ; the words in square brackets are the author’s additions which may be helpful for comprehension . Celsus’ Latin is presented in the Appendix.

‘A probe is to be passed to the end of it [*the fistula*] and the skin [*the mucosa in the rectum*] should be cut [*over the end of the probe*]. Next, through this new orifice the probe is brought out [*of the anus*] followed by a linen thread which has been thrust through an eye made for this purpose in the end of the probe. Then the two ends of the linen thread are taken and tied together so as to gently hold the skin [*this includes other important tissues like the sphincter*] which is superficial to the fistula. The linen thread should be made up of two or three strands of raw flax, twisted up so as to make one.’

Celsus then instructs that the linen thread loop is to be pulled right around through the fistula track twice each day without undoing the knot. Every third day the knot is to be undone and a fresh thread attached to one end of the old thread; then the fresh thread pulled through into the fistula and the two ends of the fresh thread tied together.

Celsus then explains the process by which the string passes through the tissues leaving the muscle repaired after the string has cut through it in 7.4.4B,

‘For thus the thread cuts through the skin [*meaning skin, muscle and other tissues*] overlying the fistula slowly, and whilst the skin [*these same tissues*] released from the thread undergoes healing,

³ Garden, Bradbury and Forsythe (2002) 360.

⁴ Garden, Bradbury and Forsythe (2002) 360

⁵ Vial, Parés, Pera and Grande (2009) 172-79.

⁶ In Celsus, *Med.* 7.4.4B. *vide infra*

that which is still gripped is being cut through. This method of treatment is lengthy but causes no pain.’

It is now known why this is such a good treatment; it is now known that a sphincter exists, what it does and, therefore, how incontinence can be avoided. The diagram in Figure 2 is modified from a 2002 text book on surgery. It shows a seton (in red) passing through the fistula and ano-rectal canal. It works because there is gentle pressure erosion of the tissues on the concave side of the seton or string in the flesh. At the same time there is healing of the tissues on its convex side, so that over a period of a few weeks or months the string and the fistula migrate through the muscle and mucosa. In this way the loop of string ends up in the ano-rectal canal and drops out. The fistula has disappeared. The muscle, although it has been cut through, has healed soundly behind the string and is therefore functioning well. The surprise referred to in the title is that Celsus seems to have known about this process

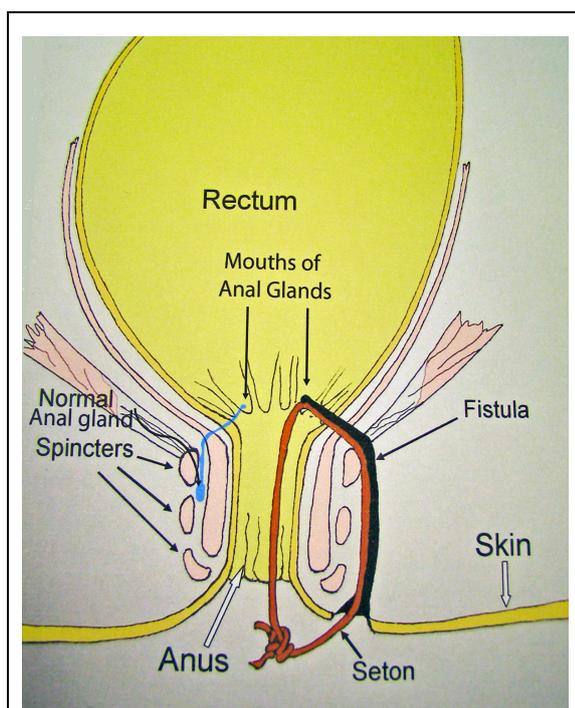


Figure 2. Diagram of a seton (red) in place in a fistula in ano (black). In Celsus' time linen thread was used instead of the seton and the appearance in a diagram would be identical.

when he wrote, 'For thus the thread cuts through the skin overlying the fistula slowly, and whilst the skin released from the thread undergoes healing, that which is still gripped is being cut through.' Did Celsus know of the existence and importance of a sphincter muscle? He makes no mention of it here or elsewhere in *de medicina*.

In his text there is the unstated assumption that this routine of daily rotation of the loop of thread through the fistula and its replacement with a new thread every third day is repeated until the fistula has disappeared which is usually in a few weeks but may be many months. He then goes on to say that for those in a hurry the loop of string can be tightened or treated with a caustic but both these options are more painful. Modern surgeons will often use a tight seton to speed up the process and their patients will concur that it is painful.⁷

Celsus does suggest that when the fistulous track is branched, or extends very deeply, the track may be laid open with a scalpel and a medicated tampon inserted. In the time before effective anaesthesia the painstaking dissection and meticulous repair of the cut sphincter are likely to have been omitted or at least significantly curtailed. Celsus gives no instructions for careful repair; to fail to do the sphincter repair very carefully is likely to result, in many, if not most, cases with significant worsening of the incontinence.

It is not intuitively obvious that a loose loop of string will slowly erode through from the fistula into the ano-rectal canal. It is even less obvious that the fistula will

⁷ Galis-Rozen, Tuclchinsky, Rosen, Eldar, Rabau, Stepanski, Klausner and Ziv (2010).

not only be healed but also that the sphincter function will be maintained. How did this technique, which is still in use today, evolve?

It is necessary to examine earlier medical historical background. There is a treatise called *ΠΕΡΙ ΣΥΡΙΓΓΩΝ* attributed to Hippocrates.⁸ In this, the author describes the origin and symptoms of fistula in ano.⁹ He also describes several treatments; the last two treatments describe cutting down on complex fistulae, risking incontinence.

In the second described treatment, the Greek author suggests a loop of string method very similar to that used some 500 years later by Celsus. The Greek author instructs that a raw linen thread, *ῥιμόλινον*, twisted round a horse hair is threaded through the fistula into the rectum using an eyed probe. It is then brought out through the anus; the probe is then removed and the two ends of the linen thread knotted. Slackness in the loop is taken up each day. If the thread rots before the fistula has cut through into the ano-rectal canal, a new thread is attached to the horse hair and it is pulled through. The author infers that the fistula will suppurate through and be cured in time.¹⁰

But there is still a conundrum: what was the Greek discoverer of this method thinking about when he discovered that a fistula could be healed by inserting a length of raw linen string up the fistula into the rectal canal and then tying the ends of the string together? It is likely that positive feedback to the physician from the patient would have been slow to arrive.

This is a possible explanation of the conundrum. The first treatment for fistula listed in *ΠΕΡΙ ΣΥΡΙΓΓΩΝ* describes a treatment in which the fistula is treated using a tampon coated with copper salts which dissolve to produce an antiseptic solution in the fistula to clean it out. In order to get the tampon to the top of the fistula a linen thread is passed through the fistula into the rectum using a stalk of garlic, not a probe.¹¹ The use of a botanical tool rather than a crafted metal one suggests that this technique may have originated in the very distant past. One end of the string hangs down from the fistula; the other end hangs down from the anus. The author does not instruct his trainee to tie the ends of the thread together, but to attach the fistula end of the thread to the antiseptic linen tampon which is exactly the same length as the fistula. To get the top of the tampon to the top of the fistula, the anal side of the thread is pulled down so the tampon is hoisted up the fistula like a flag up a flag pole. No instruction is given about what happens to the loose end which is hanging out of the anus. The trainee is instructed then to insert into the anus a hollow conical wedge of horn. It is probable that the purpose of this conical wedge is to compress the walls of the fistula against the tampon so that copper salts leak into the cavity of the fistula and cleanse it. The author states that the wedge of horn can be removed when the patient needs to answer the calls of nature. On the sixth day, the trainee is instructed to remove the tampon from the fistula and reinsert the conical, hollow wedge into the rectum for a while. The presumed purpose for reinserting the hollow conical wedge of horn after the removal of the tampon is to approximate the now clean walls of the fistula and this will result in the fistula walls first adhering together, and the fistula then healing.¹²

⁸ Joly, (1978) 134, in a comment in the Introduction (*Notice*) to the text, quotes F.Z. Emerins, and considers the author of *ΠΕΡΙ ΣΥΡΙΓΓΩΝ* to belong to the Cnidian school; he also considers the date of authorship to be the end of the fifth or beginning of the fourth century.

⁹ *ΠΕΡΙ ΣΥΡΙΓΓΩΝ*, 1.

¹⁰ *ΠΕΡΙ ΣΥΡΙΓΓΩΝ*, 4.

¹¹ *ΠΕΡΙ ΣΥΡΙΓΓΩΝ*, 3.

¹² Hippocrates, *ΠΕΡΙ ΕΛΚΩΝ*, 8, trans. Paul Potter, (1995) writes ‘Lesions that are not cleaned refuse to unite when they are joined, nor do they come together spontaneously.’ This infers that it was recognised that lesions had to be clean when their walls are brought together before they can heal.

It is unlikely that many fistulae would be sufficiently cleaned within six days for adherence of the walls and healing of the fistula.¹³ It is likely that a replacement tampon would need to be inserted to get the fistula really clean. Inserting a new string to hoist up the new tampon would have been time consuming and probably painful; it would be better to use the same string again, but finding the loose ends of the string after five days might be difficult, especially if the tampon had dropped out when the patient had opened his bowels during the period of five days. It would be easier if the ends of the string were tied together from the outset when the string had been first inserted and the tampon tied to the loop so that the first, and subsequent tampons, could be hoisted up whenever necessary. It is postulated that an antiseptic soaked tampon on a loop of string became the routine practice.

This might be regarded as an intermediate form of treatment between the first and second methods described in ΠΕΡΙ ΣΥΡΙΤΤΩΝ but some patients with the tampon on a loop of string would have failed to return for a repeat insertion of the tampon into the tender fistula. Then, in these patients, the linen tampon rotted away leaving only a loop of string. After a few weeks these non compliant patients would have found that their fistula had healed painlessly without the further discomfort and indignity from the insertion of more antiseptic tampons. This was probably recognised by some doctors who promptly adopted the tamponless loop of string as the primary method of treatment of fistula in ano.

Thus, the loop of string method which has come down to modern times, via Celsus, was probably discovered, not by deductive logic from known functional anatomy, or even by magic, but by empirical deduction from a happy accident in which some patient, or patients, failed to re-attend for surgical follow-up.

Appendix.

Celsus' Latin text used in this paper: from *de Medicina*, Book 7.4.4.

A. *Propriam etiam <num> animaduersionem desiderant ea<e>, quae in ano sunt. In has demisso specillo ad ultimum eius caput incidi cutis debet, dein nouo foramine specillum educi lino sequente, quod in aliam eius partem ob id ipsum perforatam coniectum sit. Ibi limum prehendum uinciendumque cum altero capite est, ut laxa cutem, quae super fistulam est, teneat; idque limum debet esse crudum et duplex triplexue, sic tortum, ut unitas facta sit.*

B. *Tantummodo <i>d limum bis die saluo nodo ducendum est, sic ut subeat fistulam pars quae superior fuit. Neque committendum est, ut id limum putrescat, sed tertio quoque die nodus resoluendus est, et ad caput alterum recens limum alligandum est eductoque uetere id in fistula cum simili nodo relinquendum. Sic enim id paulatim cutem, quae supra fistulam est, incidit; simulque et id sanescit, quod a lino relictum est et id, quod ab eo mordetur, inciditur. Haec ratio curationis longa <sed> sine dolore est.*

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¹³ Joly (1978) 139 n. 2 states that to remove the tampon at 5 days and expect the fistula to be clean greatly surprised contemporary medical specialists who considered that it would take a fortnight at least. I, too, would expect it to take many days for an infected fistula to become clean using only antiseptics in the days before antibiotics.

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