MEDICINA NEI SECOLI ARTE E SCIENZA, 22/1-3 (2010) 25-64
Journal of History of Medicine

Articoli/*Articles*

GYNECOLOGICAL SURGERY FROM THE HIPPOCRATICS TO THE FALL OF THE ROMAN EMPIRE

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SUMMARY

The article aimes to explore advances in the Greco-Roman gynecological surgery with particular emphasis on the Roman Empire. The development and improvement of the Roman surgical instrumentarium occurred in tandem with surgical advances, gynecological as well as general. It might therefore be said that the approach taken in this paper is one based on material culture.

The purpose of this essay is to explore advances in Greco-Roman gynecological surgery with particular emphasis on the Roman Empire. By advances I mean primarily advances in technique and greater adventuresomeness, not necessarily greater success in relieving human suffering. It is impossible to determine the latter, although it is hard to believe that new techniques did not help patients in some measure.

I will hardly be the first to chart these advances. Readers of histories of general surgery such as Gurlt's can gain an understanding of progress in the field[1]. But this comes only by picking one's way through a good many other surgical procedures. For this reason it will be useful to assemble the gynecological interventions employed by Greco-Roman surgeons practicing between the first and the third centuries ACE, a particularly innovative period in surgical proce-

Key words: Gynecology – Surgical Strumentaria – Ancient medicine

dures of all kinds. I here refer to less known surgeons who were quite famous in their day, such as Antyllus, Leonides, Archigenes and Philumenus, as well as to names everyone is familiar with, such as Celsus, the great Soranus of Ephesus, and Galen. Ironically, we have to have recourse to early Byzantines to recover the lost works of people like Leonides. This essay, therefore, depends heavily on excerpts of earlier sources collected by later compilers like Oribasius, personal physician of Julian the Apostate in the fourth century, Aetius of Amida, a contemporary of the Emperor Justinian in the sixth, and Paul of Aegina, an important but murkier figure who wrote in the seventh century of our era.

I have a second more original motive: that is to place particular emphasis on the surgical tools used by physicians of the Empire; for, their development and improvement occurred in tandem with surgical advances, gynecological as well as general. It might therefore be said that the approach taken in this paper is one based on material culture.

We have a fair number of instruments from settlement sites like Pompeii, some of which will appear here as illustrations[2]. However, the principle source for the tools of interest, let's call them the tools of Asclepius, is around 100 graves of practitioners who worked from the first to as late as the fifth century[3]. The instruments change in form and décor very little over this period of approximately half a millennium. On the other hand we have almost nothing from graves or sites from before the first century, save for a few bleeding cups. These, so far as is known, come from graves. They date from ca. 500 BCE to perhaps the Hellenistic age, their terminus ante quem being anchored by the iconography of a physician's gravestone (probably from Ialysos, Rhodes) depicting the pre-Roman type (Fig. 1)[4].

Given the dearth of surviving instruments before the first century ACE, we depend mainly on texts to gain a picture of advances made before the Empire. For the fifth and fourth centuries BCE the gynecological treatises transmitted in the Hippocratic Corpus such as

Nature of Woman, *Excision of the Embryo*, and *Diseases of Women* are the primary witnesses, whereas we have to go mainly to Celsus' *De Medicina* for the third through the first centuries BCE[5]. Although Celsus wrote his treatise under the emperor Tiberius, many of the interventions and instruments he describes were likely developed much earlier. Those relevant to this essay will be noted as we go along. As we have broached the subject of the bleeding cup, called *sikya* in Greek and *cucurbita* in Latin, we may as well begin with cupping[6].

Fig. 1 - Bleeding Cup from Thebes, National Museum, Athens (Inv. no. L 349a). Author's Photo.

Fig. 2 - Bleeding Cups from Pompeii (Naples Mus. Inv. nos. 77989, 77998). Photo courtesy of Römisch-Germanisches Zentralmuseum, Mainz (L1041/7).

This operation was of course commonplace in Greco-Roman medicine. In contrast to the pre-Roman cup shown in Fig. 1, their Imperial counterparts feature a more angular profile at the shoulder as, for example, two specimens from Pompeii (Fig. 2).

The purpose of cupping was to facilitate bleeding, or to stimulate or pressure an area of the body, generally as a way of promoting equilibrium by correcting the physical imbalance causing a problem[7]. First the interior of the cup was heated. Then the cup was placed in the afflicted place or in a place counter to it. The vacuum created as the cup cooled resulted in a draw, the pull of which varied, depending on the size of the cup and the degree to which it had been heated.

The gynecological conditions for which cupping was prescribed are numerous and sometimes consistently practiced over time. At this point the theme of continuity or consistency might be raised because, though this paper explores advances that were made in gynecological surgery, in some respects things did not much change between the Hippocratic period and the late Roman Empire. For example, the Hippocratic *Aphorisms* (5.50.1) and *Epidemics* (2.6.16) recommend cupping to control menstrual flow at one end of the temporal spectrum, while Aetius (16.64.67) and Paul (3.62.2-5) offer the same remedy at the other. So too the Hippocratic *Nature of Woman* (5.17), repeated by *Diseases of Women* (144.20 & 248.16) advise, in the wake of other procedures, fastening cups to remedy prolapse of the uterus. Along with other remedies, Aetius (16.71.55) and Oribasius (*Syn. ad Eust*. 9.55.2) do the same. As a last example, uterine moles are combated with bleeding and cupping in both the Hippocratic Corpus and in Aetius[8].

Another consistency can be observed in douching and fumigating. These procedures were employed for a host of situations. Fumigation is a basic treatment in the Hippocratic Corpus for uterine conditions such as indurated or sclerotic womb and/or cervix (*Diseases of Women* 230.8-27), for treating ulcerated womb and encouraging pregnancy (*Diseases of Women* 11.45-50; 221.2 & 34; 222.35-37), for relieving strangury or retention and painful voiding of urine (*Nature of Woman* 61.1-6) and, of course, for reducing a displaced or prolapsed uterus (*Diseases of Women* 133.36-62). In these situations the patient was seated on some chair that gave ready access to the genitalia, such as a wicker chair or a midwife's chair. This in turn was positioned over a covered vessel filled with substances varying from spices, fennel, leeks, and garlic to burnt hair and stale urine, animal and human. These ingredients were then set to smoldering or steaming by charcoal. From the covered vessel there issued a tube-

Fig. 3 - Relief from Tomb of Second Century ACE on Isola Sacra, Ostia. Photo, Dept. of Classics, U. of Washington.

it might have been a reed or the neck of a gourd-through which the fumigation passed into the genitalia.

The point is, this procedure and the devices to execute it, so amply described by the Hippocratics, reappear in more or less the same language for similar gynecological conditions in the Empire, as recommended by physicians of the status of the renowned Antyllus[9]. As it has just been mentioned, this is the appropriate place to say a word about the midwife's chair (d€frow maivtikÒw). In addition

Fig. 4 - Archaic Votives, Lapithos, Cyprus. Photo, Dept. of Classics, U. of Washington.

to the testimony of Antyllus just referenced, Soranus treats its role extensively in the birthing process (*Gyn*. 2.68). He envisages a chair having a firm back, a crescent shaped seat, open in front, on which the gravida sits, and handles for her to grip during contractions. Such a chair is depicted in the well-known terracotta relief from the tomb of the midwife Scribonia Attike at Ostia[10]. Interestingly, the midwife seems to look away from the genitalia of the gravida, exactly as Soranus directs (Fig. 3).

The Ostia relief is roughly contemporary with Soranus and Antyllus but archaic votives from Lapethos (Lampousa), Cyprus, depict the chair as early as the sixth century BCE; so it clearly was standard equipment by Hippocrates' time when the author of *Superfetation* 8 recommended it for delivering retained afterbirth (Fig. 4)[11].

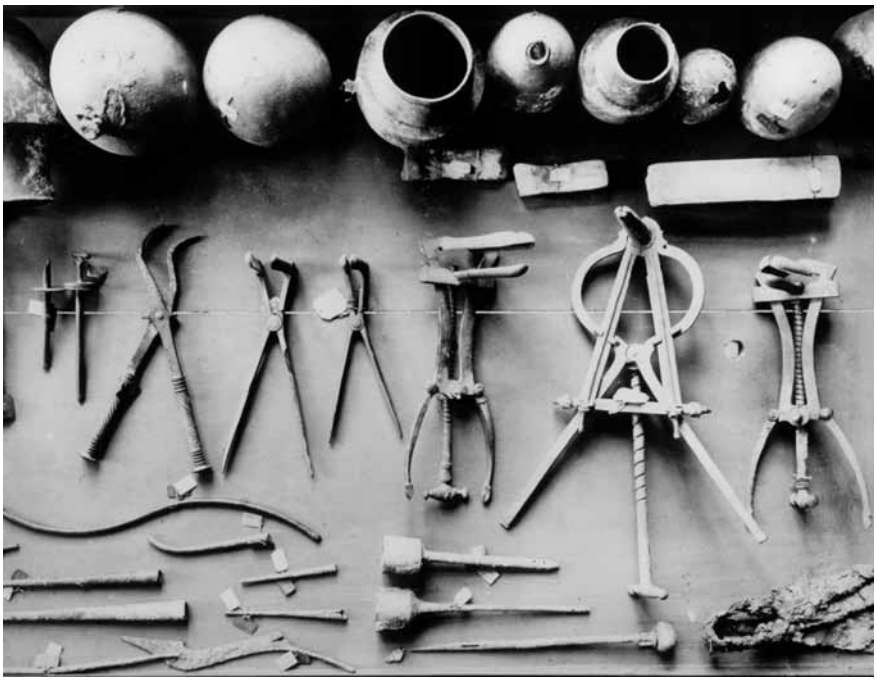

Fig. 5 - Assortment of Surgical Instruments from the Vesuvian Cities in the Naples Museum. Photo by Alinari, late 19th century.

By Soranus' time the midwife's chair had experienced some innovations; for he goes on to state that some attach to the lower part of the chair a projecting axle with windlasses and nooses to be used as an option to the embryo hook (see below) in cases of impacted fetus. These innovations most likely emerged, at the earliest, in the Hellenistic period when inventions utilizing the windlass were popular[12].

Consistency too can be observed in douching. Even a cursory perusal of Hippocratic gynecological works reveals different uterine injections for different conditions. At this point, the spotlight might be turned on one in particular, that at *Diseases of Women* 222.9-24. Here we get the most detailed description of the Hippocratic douching appara-

tus. In cases of ulcerated uterus preventing conception the physician is directed to inject a solution of mare's milk. The douche, which is contained in a sow's bladder, is injected through a tube called a *klyster (*klustÆr*)*. This is said to have a smooth solid tip of silver and, after an opening near the tip, a series of openings at intervals along its sides. The patient herself can put the tube in the proper position before the physician makes the injection. As I have often found in the Hippocratic Corpus, and as was true of the fumigation devices described above, the physician is here told "to make the tube for himself" or "to get it made" (poihsãmenow). In other words clyster apparatuses, like other tools and devices used by the Hippocratics, were not necessarily readily available. The treatise *On Joints* (7.40) nicely reflects this dearth of professionally prepared tools ready to use: "you always have to use whatever is at hand." Though no specimen of a clyster tube survives from the Hippocratic era, several expertly fashioned copper alloy models retrieved from the ashes of Pompeii closely follow the Hippocratic directives (Fig. 5, middle of bottom row).

The existence of the Pompeian tubes points to an important development: while Imperial physicians/surgeons were no less ready to administer douches and enemas, they clearly had readily available tools that were professionally prepared for their use, in contrast with their Hippocratic counterparts. This too will be a theme I intend to exploit throughout this paper.

It is time to move on from time-honored procedures to innovations, the principle concern of this essay. We may continue to deal with genital conditions. Whereas those mentioned above were treated by the Hippocratics with douches, fumigations, pessaries and medications, we hear in the medical literature of the Empire of a host of previously unmentioned situations--and the surgical means of dealing with them. These include various genital growths, such as: *thymi*, a warty excrescence (Aetius 16.117; Paul 6.71); uterine hemorrhoids (Paul 3.75, 6.71; Moschion 2.30); *hydrocele*, a fluid

filled cyst (Aetius 16.112); *condyloma*, a callused tubercle (Paul 6.71.); *myrmecia*, a subcutaneous wart that feels like the crawling of ants-hence it's name (Aetius 16.117); *acrochordon*, a wart on a neck (Aetius16.117); and, in Aetius, growths interfering with childbirth (16.23.14-18), uterine haemorrhoids (16.109), *kerkosis*, a fleshy outgrowth from the mouth of uterus (16.116), and a callous resembling millet grains (16.120)-all these in addition to the Hippocratic complaints of uterine and cervical abscesses[13].

I find only two comparable situations in the Hippocratic Corpus. The first occurs in *Nature of Woman* (42.1-11) where thrombi formed on the cervix are removed by winding a bit of vulture's hide or membrane around a *xystra*, a small strigil or spoon, and then curetting the area. The second is to be found in *Diseases of Women* (244.1-17) where directives are given for treatment of poros, a stony callous blocking the cervix and thus preventing conception. More about this latter passage in a moment.

Why do we hear more about surgical intervention for uterine conditions in Roman times? One possibility is the progress made in the knowledge of female anatomy and physiology that resulted from the dissection of human corpses allowed in Alexandria under the Ptolemies[14]. The famous anatomist, Herophilus of Calcedon, for example, closely examined the female parts and wrote on midwifery[15]. But, as this paper focuses on advances in instrumentation, one reason surely has to be the development of the uterine *speculum* (*dioptra*), which allowed for more efficient means of accessing and treating the conditions just mentioned[16]. Figure 5, middle row, features three splendid examples from Pompeii, the valves of which were opened by turning their screw fashioned handles.

Note the fine tooling on these instruments. In contrast to modern times, décor is a standard feature of Imperial surgical gear, probably because in the absence of antiseptics and modern anesthetics all surgery was bound to be painful and dangerous[17]; hence the aesthetic flair lavished

Fig. 6 - Assortment of Surgical Instruments from the Vesuvian Cities in the Naples Museum. Photo by Alinari, late 19th century.

on the tools of the trade. One thinks in this connection of the second century satirist Lucian who disparaged surgeons attempting to conceal their incompetence with fancy equipment (*Ind*. 29).

The Pompeian specula appear so sophisticated that they have actually been taken as 19th century Neapolitan productions[18]. But they have always been known to have come from Pompeii, and in 1985 I was able, with the help of documents in the Naples Museum, to trace each back to its find-spot: the House of A. Pumponius Magonianus (VIII 3, 10-12), and the Casas del Medico Nuovo I and II (VIII, 5,24 and IX 9, 3-5). One and probably two of the clyster tubes just mentioned were recovered on the latter two sites, the Casa del Medico II also furnishing a birthing hook (see below). Very likely

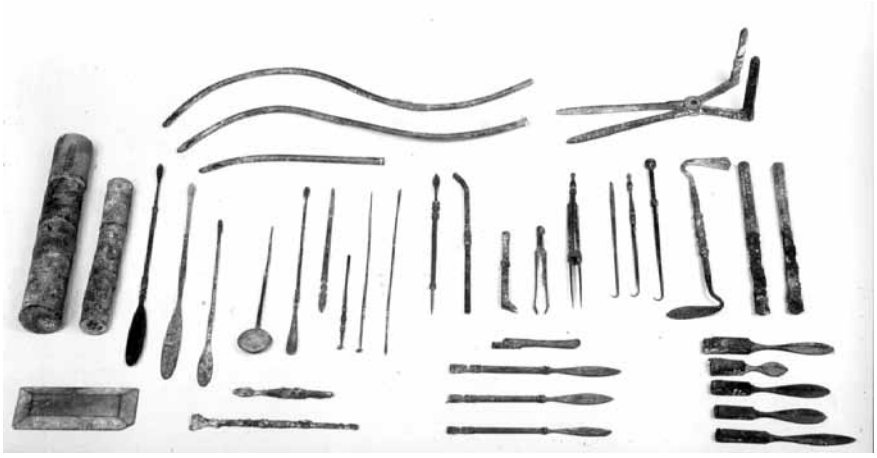

Fig. 7 - Surgical Instrumentarium from Italy. Photo courtesy of the British Museum.

other birthing hooks were extracted from the House of Pumponius Magonianus and the Casa del Medico Nuovo I. Thus were established three locations in Pompeii where gynecology was practiced as a specialty in 79 ACE[19].

The first literary witness to the existence of these remarkable tools is Soranus of Ephesus in the second century[20]; but their presence at Pompeii is proof that they were employed well in advance of his time. Surely the uterine speculum was developed sometime in the Hellenistic age, a period in which so many mechanical advances were made, including devices featuring a worm or screw. One thinks, for example, of the irrigation screw associated with Archimedes[21] and, at the same time, of innovation in surgical gear made, among others, by Herophilus' contemporary, Erasistratus of Iulis, and perhaps by Herophilus himself (see below). It is, therefore, tempting to think that the worm driven speculum was invented in Alexandria, a celebrated center of surgery in Hellenistic and Roman times.

Whatever else, the silence of the Hippocratic gynecological treatises is fair evidence that Hippocratic physicians and midwives of the fifth

and fourth centuries BCE had no such instrument. They may have had a type of bivalve dilator that expanded when its handles, revolving on a pivot, were squeezed. Imperial authorities like Oribasius and Paul recommend such an instrument for girls with underdeveloped parts, and there are numerous survivals from as early as the first century to complement their texts. Fig. 5, middle row, includes two fine specimens, one taken from the Casa del Medico Nuovo II in Pompeii and now in the Naples Museum[22]. Another appears in Fig. 7, which shows a splendid set of the first or second century from Italy now in the British Museum.

The Hippocratic author of the treatises *Haemorrhoids* (5) and *Fistulas* (3) is often credited with describing this type of speculum in connection with exposing rectal conditions. He calls it *katopter* (katoptÆr) or "tool you look down with." Now, the concept of a surgical tool consisting of two elements revolving on a pivot was familiar to the Hippocratics who, as we shall see, attest to such an instrument in, for example, the tooth forceps and the uvula forceps (see below)[23]. One of a number of Roman examples of the latter can be seen in Fig. 6 (middle row, 9th from right), identifiable by its serrated spoon-like jaws.

Furthermore, the language used in *Haemorrhoids* "when (the *katopter*) is being opened …" suggests a genuine pivot mounted speculum. But there are difficulties in identifying the Hippocratic *katopter* with the instruments in the Naples and British Museums, which, by the way, went by other names in the Greek of the Empire[24]. First, there is the fact that Celsus, who may provide our earliest description of the instrument (the passage is controversial), does not name it (7.5.2b). This has prompted the suggestion that the bivalve dilator was only recently developed, at least in the form assumed by the surviving examples[25]. Then there is the fact that the first century Hippocratic commentator Erotian defined the Hippocratic term *katopter* as a *melotis* (mhlvt€w) or spoon probe[26]. If so, the *katopter* may only

have been one or two spoons, the operator expanding and examining the rectum by inserting and then pulling them (or it) sideways. The matter is presently irresolvable and underlines the difficulties of treating Hippocratic surgery without the benefit of contemporary instruments to complement Hippocratic texts.

Whatever else, one never hears of the *katopter* in connection with Hippocratic gynecology. Rather the Hippocratic method of uterine dilation was mainly through the insertion into the cervix of a simple lubricated probe or even a finger. Better yet, in the event that probing was preferred, it was likely to be with a series of probes graduated in size, each succeeding one thicker than the last. J.S. Milne, a pioneer in the study of Greco-Roman surgical tools, compared them to the dilators in his time termed "Hegar's dilators[27]." Hippocratic probes/dilators will be treated in greater detail presently.

Key to putting on the stretch for excision the growths we have cited from Imperial texts is the *mydion*, called *vulsellum* in Latin, names associated by scholars with an abundantly surviving spring forceps with broad dentated jaws[28]. Examples can seen in Fig. 6 (middle and bottom rows) and Fig. 7 (middle row, 9th from the right). Note that some specimens feature a sliding catch to hold their dentated jaws in place. A slot at the upper terminus of the piece in Fig. 7 shows that it also mounted a cutting blade, which is now missing[29]. A companion smooth jawed type to its immediate right also features such a blade-slot.

Not surprisingly we do not hear of this instrument in the Hippocratic Corpus. We do hear of some heavy-duty pliers-like forceps that also occur frequently in Imperial sources and that have been identified among archaeological survivals. One is the *osteologon*, about which I shall speak in a moment. Two other types are mentioned in passing in *Physician* (9.1-4); these are the *odontagra (*Ùdontãgra*)* and *staphylagra* (stafulãgra)or, respectively, the tooth forceps and the uvula forceps. The former, according to Soranus (4.11.5) and

Paul (6.74.3), was deployed for crushing and removing fragments of fetal skull in abortions. The *staphylagra*, while not explicitly connected with gynecology was, Paul says (6.78.2 and 6.79), used in operating for hemorrhoids and fistula, conditions afflicting women as well as men; obviously such a forceps would also have been suitable for gripping the uterine growths listed above. Unfortunately, we told nothing of the function of these tools in *Physician* which, in any case, is now thought to be no earlier than 250 BCE, meaning that *Physician* is an Hellenistic production. The only Hippocratic uterine intervention that is comparable is one previously mentioned in *Diseases of Women* (244.1-17) for the callous called poros. This we are told may be plucked away "with a very fine *labis* (lab€w)," a term later usually designating only a common domestic tweezers. Imperial tweezers are legion, many having been recovered from sites like Pompeii[30]. Some sturdier types were useful to physicians as forceps and are found in Imperial instrumentaria, for example, the pointed-jawed specimen in Fig. 7 (middle row, 7th from right)[31]. So, similar models may lie behind the one literary testimonium we have to the Hippocratic *labis*. Still, even there the *labis* is only brought into play after medicating with a probe has been tried, the "probe" in this case being simply a bunch of fine soft feathers dipped in rose oil. All told, it seems that surgical forceps were not widely used in Hippocratic surgery.

Also often mentioned by Imperial authorities for piercing and raising the uterine growths of interest to us were retractors. For good examples we can again have recourse to the fine Italian instrumentarium in the British Museum (Fig. 7, middle row, 4th - 6th from right) and to the holdings of the Naples Museum (Fig. 6, 1st and 2nd, bottom row). Note their fine tooling, as with the specula. Neither the sharp model, which was called *ankistron* (êgkistron), or the blunt type called *typhlankistron* (tuflãgkistron) is attested to in the Hippocratic Corpus[32]. One item that arouses curiosity is the *ankyromele* or "anchor probe,"

a name suggesting a hooked instrument. Both Galen (19.69.7K) and Erotian (51.5) list the term in their *Hippocratic Glossaries*, defining it as the *ankistron* or sharp hook known to them. But *ankyromele* is not a name found in the Hippocratic Corpus as we presently have it. Still, if Erotian and Galen equated the *ankyromele* and the *ankistron*, they must have had at least one text in front of them that involved raising tissue, a blood vessel or the like with a hooked retractor. Of course there is no way of connecting the text they had before them with gynecology. Furthermore, the dearth of testimony to retractors in Hippocratic literature, in contrast to the common mention of such instruments later, makes it doubtful that sharp or blunt retractors were widely used in the fifth and fourth centuries BCE. Occasionally, even in the literature of the Empire we find a forceps or fingers substituted for the sharp hook[33]. It would seem that Hippocratics employed fingers for retraction as a matter of course.

As to the actual excision of *myrmecia, acrochordon*, etc. in Imperial times, a variety of knives were employed. Generally, a simple scalpel was used[34]. Imperial scalpels are extremely well designed instruments. The standard model consists of a rectangular or polygonal handle mounting a leaf shaped dissector at one terminus and, where they are preserved, a blade at the other. Most surviving blades are of the rotund "bellied" or "breast shaped" types[35]. For the growths we are dealing with, or for severing the umbilical cord, specimens with straight blades would be quite appropriate[36]. Eight of the standard Greco-Roman types, minus their blades are contained in the Italian set in the British Museum (Fig. 7, lower right). But the ten specimens from Pompeii in Fig. 6 (top row) show the usual blade shapes[37]. The body of each of these scalpels is comprised of copper alloy, the blade of iron/steel.

In situations requiring an instrument for excising or lancing, the preferred Hippocratic designation is simply the general term for "knife": *machairis* (maxair€w) and its diminutive *machairion*. Other

than the indistinct knife poised for blood letting in the hand of a surgeon shown on a well-known Athenian red-figure vase of the mid fifth century BCE in the Louvre, there are no material Hippocratic survivals[38].

We thus have only nomenclature to go on. That employed leads to the conclusion that the "scalpel" or "phlebotome" in the Hippocratic instrumentarium amounted to no more than a suitable everyday knife employed in household or shop. In contrast, the surgical literature of the Roman Empire regularly features the technical term *smile* (sm€lh) *scalpellum* in Latin) and its diminutives *smilion*/*smilarion*. This demonstrates that, in addition to many new surgical tools, there was an expanding technical vocabulary reserved for them.

Moreover, in addition to the *smile* there were other surgical knives recommended by Imperial authorities for these and other situations affecting the female genitalia. They include the *katias* (kat€aw), the *spathion* (spãyion*)*, or "knife shaped like a small spatula", the *hemispathion* (±mispãyion), the *polypikon spathion (*polupikÚn spãyion*)*, or polyp knife, and the *syringotomon (*suriggotÒmon*)*, or fistula knife[39]. There are few material survivals that we can clearly link with these names; so texts that describe them and their very names are what we have to go on. The polyp knife is said to have consisted of a blade shaped like a myrtle leaf (therefore resembling a spatula) at one terminus and a scoop at the other. This means it must have mounted its blade on a shaft, and the same seems true of the *katias*[40]. All indications are that these instruments were lancet-like, as was surely the case with the *ergaleion lonchetikon* (§rgale›on logxhtikÒn) or "lancet tool" attested to by Aetius for dividing an imperforate hymen (16.108.25). A fine lancet-cautery combination included in a marvelous kit from Asia Minor, possibly Ephesus, now housed in the Römisch-Germanisches Zentralmuseum, Mainz, serves in a general way to illustrate the lancet typology (Fig. 9).

Fig. 8 - Cranioclast and retractor (serving either as embryo or lithotomy hook or both) from Meyer-Steining Collection. The former is now missing. Photo reproduced from Meyer-Steining (1912) Taf. VI.

It is uncertain what the other names designated. The *spathion* was clearly equated with the *polypikon spathion* on occasion; so it too may merely have been a lancet[41]. In the case of the *hemispathion*, or "half spatula," its name suggests a common scalpel of the bellied or breast shaped type with which we are familiar. An argument can be advanced that in some instances the *syringotomon* was also a common scalpel but with a straight blade[42]. Whatever form these cutting instruments assumed, all were employed for interventions in the genital orifices of the female body; therefore, they had to be suitable for work in confined places where care had to be taken not to cut or puncture anything but the targeted tissue. In contrast, knives are not brought to bear in Hippocratic gynecology except in the case of difficult births. It is to these and the instruments used in their connection that we now turn.

Perhaps the most hair raising female intervention performed by the surgeons of the Empire is the abortion of an impacted fetus. This obstetrical procedure was called *embryoulkia* or "pulling out the fetus". It was required when the child could not be passed, either

because the mother's pelvis did not sufficiently expand, or because the child was hydrocephalic, or because it had died and begun to swell in the womb. Under these conditions the only option, if the mother was to be saved, was to extract the fetus. The following synopsis depends on several accounts, principally those of Soranus (*Gyn*. 4.9-13), Aetius-who depends on Philumenus (16.23)-and Paul (6.74). First the uterine speculum was brought into play to dilate the parts and allow for inspection of the situation before other tools were deployed[43]. According to the Christian apologist Tertullian, if the child was yet alive, it was first dispatched with an *embryosphaktes* (§mbrusfãkhw) or "embryo killer", an instrument he associates among others with Herophilus. This instrument is thought to have been a special lancet or needle[44]. If the child was dead but the skull was hydrocephalic, the skull was opened for evacuation of its contents by cutting instruments with which we are already familiar, the *smile* for example, or the polyp knife, or a knife called by Soranus *embryotomon* (§mbruotÒmon)[45]. If the child could not be passed at this point, the skull might then be broken up with a cranioclast called *embryothlastes*[46] or simply collapsed by hand and the remnants extracted by the bone forceps (see below) or the tooth forceps[47]. Cutting instruments were also brought to bear in situations where the torso was too large or had become bloated, so that it had to be evacuated of its organs and/or dismembered. In this case, the corpse was brought out piece by piece.

But of prime importance in *embryoulkia* was a powerful sharp retractor called *embryoulkos* (§mbruoulkÒw) or "embryo puller" which was planted in pairs at convenient locations. To make the use of embryo hooks more vivid, let us paraphrase the account of Soranus (*Gyn*. 4.9.11). When the gravida is secured to a bed and her labia dilated, Soranus has the physician introduce the *embryoulkos*, lubricated in olive oil, clutched inside the fingers of his right hand and guided by the left. After he sets the hook in any suitable place where

purchase can be gained (e.g. the eyes, collarbones, etc.), he sets a second *embryoulkos*. The hooks are then turned over to an experienced assistant who draws on them steadily, sometimes pulling them from side to side, while the physician maneuvers the position of the fetus and applies olive oil as a lubricant. As the fetus comes free, it may be necessary to remove the hooks and reinsert them at an advanced level. It may even be necessary to amputate parts of the fetus before the hooks are applied. So goes the radical intervention called *embryoulkia*[48].

As to the tools used in *embryoulkia*, we have already seen splendid Imperial survivals of the scalpel, lancet and the uterine speculum. We can also produce good specimens of the *embryoulkos* from Pompeii, the site at which several were come upon (Fig. 6, second row, far right; and Fig. 8)[49]. Each consists of a handle of copper alloy into which there was pegged a robust iron hook. One can be documented as having been found along with the *specula* and clyster tube we have traced to the Casa del Medico II in Pompeii, and I have elsewhere tried to demonstrate that very likely all of the Pompeian specimens were recovered in instrumentaria including *specula* and other instruments of gynecology[50].

In addition to embryo hooks, part of an *embryothlastes* has survived to be included in the collection of surgical gear assembled early in the 20th century by the German ophthalmologist Theodor Meyer-Steineg (Fig. 8)[51]. Unfortunately, the piece is now lost but a good photo has survived. As with the tooth forceps we are dealing with an instrument operated by squeezing handles revolving on a pivot. Ernst Künzl, who along with Susanne Zimmerman has republished the collection, suspects that the Meyer-Steineg *embryothlastes* may be early Byzantine[52]. Even if this is so, it surely resembles earlier models in the main.

We have mentioned once again the tooth forceps. Several specimens of the similarly constructed bone forceps or *ostagra* (Ὀστᾶγρα) also

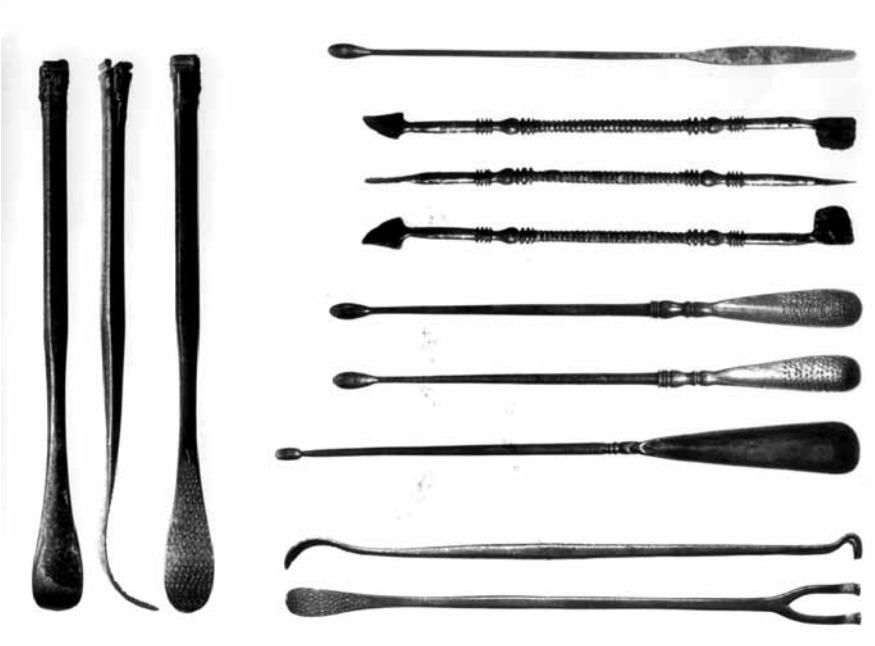

Fig. 9 - L. to R. Spatula, lancet-cautery, two spoon-probes (one with roughened interior), a lithotomy hook and (bottom) a combination lithotomy hook and knife. Photo courtesy Ernst Künzl.

survive. To illustrate its features we may once again have recourse to the Naples Museum for a specimen from Pompeii in (Fig. 5, middle row, 4th from left)[53].

I have said that embryotomy is amply documented in sources like Soranus, Aetius and Paul. Interestingly there are also accounts of the operation in the Hippocratic Corpus, and it is here that Hippocratic procedures seem most to parallel those of a later age in radical surgical operations[54]. The chief difference is in the names of the instruments used. In extracting a dead and bloated embryo the author of *Diseases of Women* (70.1-28) recommends first beheading it with a common knife (*macharion*), the only stipulation being

that the knife be more curved than straight[55]. Next the head is to be broken up with a cranioclast, called in Hippocratic Greek *piestron* (p€estron) or "squeezing tool," as opposed to the later name *embryothlastes*. Galen in his *Hippocratic Glossary* also attributes to Hippocrates the name *thlastes* (ylãsthw) for the *piestron*, although it does not occur in the present Corpus[56]. For plucking out the fragments of the now crushed skull a type of bone forceps was brought to bear. I have previously noted that it was called by Hippocratics *osteologon* (ÙsteolÒgon). The name means literally "bone extractor." The *osteologon* must therefore have been an instrument resembling the sturdy pliers-like forceps that goes by the name *ostagra* in Roman times. Ironically, the *osteologon* is not attested to in the Hippocratic tracts on bone surgery: its sole mention comes in the third book of *Diseases of Women*, also transmitted under the title *Barrenness* (249). The same passage in *Diseases of Women* recommends the *helkuster* or "pulling tool" for extracting the rest of the fetus. As the instrument has to be attached to the clavicle and then pulled on, sometimes with greater and sometimes with lesser force, there is little doubt that the Hippocratic *helkuster* (§lkustÆr) was a hooked instrument; thus, Galen in the *Hippocratic Glossary* (19.97.9K) does not hesitate to equate the *helkuster* with the *embryoulkos*, the sturdy hook used for the purpose in his time. Galen also tells us in the same work (19.107K) that another Hippocratic name for this kind of hook was *ikhthye* (fixyÊh) after its resemblance to the pattern created by the superimposed scales of a fish (*ikhthys* in Greek). This term he found in *Excision of the Fetus* (1.1-15) where the *ikhthye* is fastened to the exposed bones of the baby's hand before traction is made.

In addition, the Hippocratic work *Superfetation* (7.1-10) mentions a knife for dismembering an impacted embryo, which does not figure in later sources. The author calls it *onyx* or "claw," apparently a blade attached to a ring[58]. It should be worn, we are told, on the thumb

after the hand has been covered with wax, so as to be more easily introduced into the womb. This *onyx* is reminiscent of a sharp blade mentioned in *Diseases* 2.28. The latter was attached to a ring got up to strike the epiglottis in cases of acute sore throat[58]. The ring blade in *Diseases* is clearly a device created on the spur of the moment, and prompts the notion that the onyx of *Superfetation* was also not a regularly used tool.

While the Hippocratic instruments of abortion and the procedures employing them come impressively close to the operation and the tools of Imperial times, like the many uterine interventions we have observed, other Imperial procedures cannot be paralleled in Hippocratic texts. One glaring example is surgery for breast cancer. Essential to this operation was the *kauterion* (kautÆr/ kautÆrion) or cautery used for stanching the flow of blood. The standard type is illustrated by the fine specimens in the Naples Museum appearing in Fig. 6 (middle row. 9th -11th from left) and by the lancet cautery combination from Asia Minor now in the Römisch-Germanisches Zentralmuseum, Mainz (Fig. 9)[59]. These consist of a therapeutic plate offset from the shaft, so that only the plate touched the affected part. Other models appear in Fig. 7 (bottom row, left)[60]. In addition to instruments designed exclusively for cauterization, spatulas and other probes as well as iron/ steel scalpel blades were also employed for this purpose. To protect the hand of the operator the shafts of these cauteries would have been inserted into a handle or wrapped in some sort of insulating material, such as a rag (Galen, *Simples* 12.267K).

Cauteries called *sideria* (sidÆria), or irons, are widely attested to in the Hippocratic Corpus. As usual, they are regularly made up on the spot, as for example in treatment of hemorrhoids, where iron spits with rounded terminations are prepared (*Haemorrhoids* 2.4-6). But, insofar as the present Corpus is a witness, cauteries are not employed for cancer of the breast or for any other gynecological intervention.

In fact the only Hippocratic reference to breast cancer is at *Epidemics* 5.101, a passage repeated at *Epidemics* 7.116.

> *A woman at Abdera had breast cancer. A bloody fluid flowed from her nipple. When the flow stopped she died*[61].

Here we find only the detached observation so characteristic of much of *Epidemics* with no indication that breast cancer was treated surgically in the fifth and fourth centuries BCE[62].

But back to the Empire. Surgery for cancer of the breast is described by Paul of Aegina (6.45), who states that some excise the breast completely: in other words actually attempt mastectomy. Not so Paul; following Galen he favors only removal of the tumor. This too is the method preferred by Aetius who supplies the most detailed account of the operation (16.44). Aetius depends on Archigenes and Leonides who, as we have noted, were two famous surgeons of the first to second centuries. He copies the actual procedure from Leonides. The procedure involves incising to access and remove the tumor with frequent cauterization to stanch the bleeding then more cauterization to insure complete cure of the disease.

In fairness to the Hippocratics it is impossible to know how successful Imperial surgeons like Leonides were. One can only say that, if they bothered to describe their methods, the results, whatever they were, must have been sufficiently acceptable in their own minds.

Another radical Imperial gynecological operation was hysterectomy. Soranus is witness to the procedure. He tells us that it was performed when a prolapsed uterus had become gangrenous (*Gyn*. 4.40.1). In this situation the uterus might be excised in part or, in some cases, even completely. It is not clear that Soranus himself ever performed the operation as he depends on Themison, an important physician/surgeon of the first century (*Gyn*. 1.15.1). But it is clear that he approves of it and is convinced that the intervention could be carried

out without danger. Aetius, who copies him, allows for partial excision but seems less convinced about removal of the whole when he observes, "In fact there is testimony that even the entire uterus when gangrenous was amputated and the woman lived[63]." In this case it appears that later Imperial surgeons became reluctant to continue performing an earlier more adventuresome procedure.

On the other hand Aetius seems much more confident about the repair of various hernias for which we find no surgical remedy in the Hippocratic Corpus. These include hydrocele, bubonocele, and cirsocele. All these conditions are treated by other authorities of the Empire, but only as dealt with in men. Aetius alone describes in detail the different surgical procedures and instruments necessary in female cases in his treatment of gynecological conditions in the sixteenth book of his treatise. His source for these daring interventions is a lost work(s) by Aspasia, an obscure female practitioner on whom he depends extensively for all sorts of gynecological problems[64].

In the case of hydrocele which, as its name indicates, is a hernia caused by fluid collecting around the greater labia, sometimes on one side, sometimes on both, the surgeon first makes an incision over the mass and dissects through intervening tissue. He then retracts this tissue with sharp hooks (*ankistra*), punctures the mass, and evacuates the fluid. The final step is to strip away the tissue forming the sack that surrounded the fluid, to medicate the area and, finally, to close with two or three sutures (16.112).

A bubonocele is an inguinal hernia. It occurs when the peritoneum, the membrane lining the abdominal cavity, is ruptured or separated. The result is that the intestine descends, in men into the scrotum, in women (according to Aetius) generally to the right side of the vaginal opening. To correct it, the bubonocele is exposed by incision and dissection, the intestine reduced to its proper position, the peritoneal membrane tied and sutured and any superfluous part of it excised.

Two or three sutures serve to close the wound, which is then medicated and dressed (16.113).

Aetius/Aspasia next tells us that cirsocele occurs in the greater labia and can be treated surgically in the same way as varicose veins. In fact a cirsocele is simply a varix of the female parts. The operation consists of making an incision over the vein, dissecting to expose the ruptured part, elevating it, tying off the ruptured part at each end and then amputating it at the points tied off. The wound is then to be closed with the usual two or three sutures and medicated (16.114).

For two of these hernial surgeries, in addition to scalpels for incisions, the retractors/hooks we do not find in the Hippocratic Corpus are required. We have already noted the sharp variety used to expose hydrocele in women; but to elevate a cirsocele the blunt/dull model called *typhlankistron* (tuflãgkistron) is prescribed by Aetius/Aspasia, the only attestation to its use in treating women surgically. The *typhlankistron* is not infrequently mentioned in other Imperial texts, including interventions to correct vericose veins elsewhere on the body. A specimen can be seen in the instrumentarium depicted in Fig. 7 (middle row, 3rd from right). Yet another type of hook makes an appearance at Aetius 16.111. This is the retractor for bladder stone called *lithoulkos* (liyoulkÒw). Its defining characteristic is its roughened inner surface, which allows for a firm grip on the stone[65]. Often, it is complemented by a blade at its opposite end. In this case the hook-blade ensemble is called in Greek *lithotomon* (liyotÒmon). Spoon probes too have been recovered having the same sort of roughened interior surfaces. These also appear well suited for the retraction of stones. All types may be seen in the set from Asia Minor in Mainz (Fig. 9).

Imperial accounts of the operation for bladder stone concentrate on males in the main because, we are told, the straighter, shorter and wider female urethra better allows for stones to pass out in the urine. However, the surgery on females is described twice: in the passage just cited in Aetius, likely also taken from Aspasia, and by Celsus (7.26.4)

who in fact provides the earliest account we have of the operation on either sex. In the case of both men and women we are told that the operator must force the stone into the neck of the bladder with his index and middle fingers. In males the stone is accessed through the rectum, in females through the vagina, though rectal access is advised for virgins. When the stone has been digitally maneuvered into position, it is forced upward until its outline appears: in men to the proper left of the perineum, in women above the greater labia (according to Aetius), or between the urethra and the pubic bone (according to Celsus). It is then exposed by incision, and extracted by the *lithoulkos*. Students of Hippocratic medicine are well aware of the passing mention of lithotomy in the famous Oath (17-18), the sole mention of it in the entire Corpus:

> *I will not operate even on people suffering from stone but I will entrust this to skilled practitioners (*§rgãthsin*).*

In spite of this reference one may doubt the practice of lithotomy by Hippocratics. For one thing, the date of the Oath is uncertain: the whole or parts of it have been placed by scholars in chronological contexts ranging from the fifth century BCE to the Hellenistic Age[66]. If the reference to "skilled practitioners" is as early as the fifth or fourth century, then of course lithotomy was practiced at that time. However, "skilled practitioners " – if by that specialists such as lithotomists are meant -- are much more at home in the Roman Empire when, as noted, we find the first actual description of this surgery in the pages of Celsus[67]. On the whole one can question the existence of lithotomy before the Hellenistic Age. But even if lithotomy was practiced as early as the fifth or fourth century BCE, it is highly unlikely that the fine tools recovered from Imperial graves and attested to in Imperial sources as specifically designed for lithotomy were available.

If we revert to the subject of tubes, in addition to clysters a number can be found utilized in female interventions at all periods of Greco-Roman medicine. In the Hippocratic *Diseases of Women*, for example, a tube called *motos* (motÒw) is employed for treating a uterus displaced toward the hipbone. Its function is to soften the cervix when filled with the kneaded fat of an ewe and inserted (133.101 -115). Many centuries later, Aetius (16.108.34 & 55) recommends a tin tube or *syringion* (sur€ggion) to prevent adhesion after an imperforate cervix/vagina has been opened. I cite these passages, not because they are witnesses to the same operation but, again, because of the contrast in securing the tubes used. The Hippocratic tube has to be made; whereas Aetius inserts a tube that is to hand in his gear, the same type of tube as was found, for example, in the House of the Surgeon at Pompeii (Fig. 5, lower left, larger specimen)[68].

The same theme can be repeated again in dealing with the probes used for exploring, tracking, dilating and medicating when one compares the female treatises of the Hippocratic Corpus to the treatments of female conditions in Imperial texts. Take for example the Hippocratic *Diseases of Women*. There hydrops or watery discharge of the womb (60.20-27; cf. also *Nature of Woman* 35.23-25) is medicated with a tin probe or mele (mÆlh kassiter€nh) made up for the purpose. At 244.6-15 a cervix blocked by poros, a stone-like callous, is opened with a *mele* that turns out to be no more than a bunch of fine soft feathers dipped in rose oil. And in a lengthy passage (133.80-135) prescribing measures for redirecting a displaced uterus to its proper position and promoting menstruation, the treatment requires, in part, insertion of six graduated probes into the previously fumigated cervix. This time the probes are called *prostheta* and *daidia* (prosyetã; daid€a). These are round, pointed at each terminus, and measure ca. 4.2 inches in length. The largest of the set is to be as thick as the index finger and smaller at one terminus than at the other. As these dilator/probes were of pinewood, there is concern that they should not be marred by splin-

ters and should be lubricated with fat to facilitate their insertion[69]. It is clear from the text that these *prostheta/daidia* were not a permanent item in the tool-box but were produced on site for the purpose at hand. The same is surely true for the single probe/dilator called *molybdion* (molÊbdion) or "little piece of lead" inserted before and after fumigation at *Diseases of Women* 11.49-52 in preparation for coitus with the goal of pregnancy. So the Hippocratic female treatises present pretty much the same picture with probes/dilators as the rest of the Corpus where we also hear of probes gotten up for the purpose, again as though there were few permanent models. One simply fashioned them of such material as was available or recommended for the surgical maneuver in question.

In contrast Leonides, Antyllus, Archigenes and the Imperial and Byzantine authors who exploited their treatises in constructing their own could buy and keep the various types of probes that were ready made by the metal workers of the Empire[70]. These included the spatula probe or *spathomele* (spayomÆlh) and the spoon probe *mele/melotis/melotris* (mÆlh/mhlvt€w/mhlvtr€w) as seen on Figg. 6, 7, and 9[71]. In gynecology and obstetrics Soranus attests, though disapprovingly, to the former as a cautery to stanch the hemorrhaging umbilical cord of a newborn (*Gyn*. 2.11.4). Both types found ready use in the preparation and application of the numerous drugs, salves and plasters thought effective for female complaints, as for example, in medicating uterine abscess or in arresting uterine hemorrhage (Soranus, *Gyn*. 3.41.5) and hysterical suffocation (Aetius 16.67.94). To this end both the spatula and spoon probes of the Empire featured at one terminus an enlargement for grinding and mixing called in Greek *pyren* (purÆn). The same was true of the *dipyrene* (dipÊrhnow mÆlh), a simple shaft with a *pyren* at each end, as its name indicates (Fig. 6, bottom row, 4th, 7th and 9th from right and Fig. 7, middle row, 11th from the left). The *pyren* was sometimes rotund, more often oblong, and it was the *pyren* terminus of each of these types that also

saw duty as a probe: in tracking mammary fistula (Aetius, 16.40.22), for example, or in determining the nature of a uterine prolapse (Soranus, *Gyn*. 4.36.3). Likewise, probes were utilized in testing for virginity (Soranus, *Gyn*. 1.17.3) and pregnancy (Aetius 16.1.58), and in measuring the depth of the vagina to determine the appropriate speculum in accessing an abscess (Aetius 16.89.10, Paul 6.73), in treating uterine fistula (Aetius 16.31.32), in adjusting a malpositioned uterus (Aetius 16.72.47), and in dividing obstructing tissue in cases of imperforate uterus/vagina (Aetius 16.108).

We may conclude this survey with catheterization. There are many references in Imperial texts to evacuating a malfunctioning bladder with a catheter tube (kayetÆr), called by that name then as now. Catheters were lubricated for insertion into the urethra with olive oil and animal fats. Of special interest here are the different types used for men and women. Celsus and Pseudo-Galen distinguish the S-shaped male from the shorter and less radically curved female type, both models being exemplified in the instrumentarium from Italy now in the British Museum (Fig. 7, top row). A male catheter in Naples also appears in Fig. 5, lower left. The different sizes accord with Celsus' advice that the physician have a number of sizes available, and Aetius and Paul too speak of catheters appropriate to the age and sex of the patient[72].

Any general history of surgery will tell you, following Pseudo-Galen (14.751 & 788K, *Introduction or Physician*)[73], that the S-shaped catheter was developed by Erasistratus; hence its presence in Roman instrumentaria. But, in fact the Hippocratics too had available tubes that could be used as such. At *Diseases* 1.6.12 we are told that, in addition to other diagnostic and procedural skills, the mark of a physician is to know how to insert an *auliskos* (aÈl€skow) or "tube" into the bladder. *Auliskos* is not the Imperial term; but what else besides a catheter can be meant? So, if the author of *Diseases* 1 is right, Pseudo-Galen must be in error. And if that is true, Erasistratus' contribution

to the development of the catheter involved some other refinement; or it may be that he was remembered for applying the S-shaped catheter in certain previously unheard of situations[74]. But the point is that the Hippocratics clearly had catheter tubes, and one reasonably assumes that these included models suited to the female urethra. Unfortunately, *Diseases* 1 allows us to assume no more than that the Hippocratic catheter was used to evacuate the bladder, its basic function then and later. In strictly female operations, for example, Soranus evacuates the bladder in cases of dystocia or difficult birth and in advance of reducing prolapsed uterus (*Gyn*. 4.7.8 = Aetius 16.22.68 and 4.38.1 = Aetius 16.71.34), as does Aspasia in the course of correcting various malpositions of the uterus (Aetius 16.72.61)[75]. However, Imperial sources attest to other female functions as well. Among these we find Soranus thrusting a stone lodged in its neck back into the bladder in the case of dystocia just mentioned, and Aetius inserts a catheter to protect the urethra while incising imperforate vagina (Aetius 16.108.21). The female model also found non-gynecological applications, as in the text of Caelius Aurelianus (CD 3.133) who attests to its deployment as a cannula to drain ascitis (dropsy) irrespective of sex.

Conclusions

What can we conclude from the sources assembled and examined?

Anyone interested in the surgical texts of the Roman Empire soon realizes that there are more and more adventuresome operations attested to than we find in the Hippocratic Corpus. A cursory reading of the sixth book of Paul of Aegina demonstrates this amply. Note, for example, his expressed surprise at the reluctance of Hippocratics to amputate arms and legs (6.121). In contrast, he and the surgeons of the early Empire on whom he depends are prepared to perform lithotomy, surgery for scrofulous swellings and a variety of hernias, and to execute major amputations, all procedures surely made possible by techniques developed in the Hellenistic period for

ligating blood vessels[76]. In short, the Hippocratic surgeon, however admirable his sense of enterprise, was less capable. As we have seen, this holds true for gynecological surgery as well; however, not quite to the extent that one might think. The greatest advances made by Greco-Roman surgeons look to be in their ability to access and excise uterine growths and correct hernias. Moreover, they, or at least some of them, were adventuresome enough to attempt hysterectomies and operate for cancer of the breast, even to the point of mastectomy, though we do not know the precise nature of the cancerous conditions they treated or how advanced they may have been. In other respects, though, the Hippocratics were not so far behind, if behind at all. Their procedures for fumigation, clystering, douching and probing were a match. They seem to have been proficient in catheterization. And, surprisingly, in the daring abortions of impacted fetuses, their methods were virtually identical to those of their later counterparts. The one imposing departure is in the quality and availability of the tools needed for these procedures. Not only are fewer tools of the trade attested to in Hippocratic literature but, in contrast to the fine professionally prepared instruments extracted from Roman sites and graves, it seems, as we have already observed, that not infrequently the Hippocratic employed items not intended for medical purposes, or was obliged even to create what he needed on the spot. Again the injunction in *Joints* 7, "you always have to use whatever is at hand," comes readily to mind[77]. Though the surgeon of the Empire too occasionally used whatever was available, the tools extracted from graves and sites like Pompeii make it clear that he had regularly to hand fine knives, forceps, probes, retractors, cauteries, surgical tubes such as catheters and remarkably modern gynecological instruments, including the intricate specula that survive today as monuments to the technical expertise of the Imperial craftsmen who manufactured them. This is not to say that that the fifth and fourth centuries BCE knew

nothing of special forceps, catheter tubes and, perhaps, birthing tools that included some sort of hinged dilator or speculum. But the general picture that emerges is one of a much inferior Hippocratic toolbox, not only in gynecology, but in general.

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3. KUENZL E., (with the collaboration of Hassel F. J. and Künzl, S.), *Medizinische Instrumente aus Sepulkralfunden der römischen Kaiserzeit*. Bonn, Rudolf Habelt, 1983 = Sonderdruck aus den Bonner Jahrbüchern Bd. 182, 1982.
4. BERGER E., *Das Basler Arztrelief: Studien zum griechischen Grab und Votivrelief um 500 v. Chr. und zur vorhippokratischen Medizin*. Mainz, Philip von Zabern, 1970.
5. Translations in this essay are mine. Those from the Hippocratic Corpus are based on the text of LITTRÉ E.
6. The basic meaning of *sikya/cucurbita* is gourd, the bleeding cup taking this name because it is shaped like one. Only the gourd shaped type of cup made of copper alloy survives; therefore I concentrate solely on it. Other shapes and materials, such as clay and glass, were also employed. For these see MILNE, J.S., *Surgical instruments in Greek and Roman Times*. Oxford Clarendon Press, 1907 (Reprinted New York, Augustus M. Kelley, 1970), pp. 101-105 [with the caveat of KUENZL E., *Ventosae cucurbitae romanae? Zu einem angeblich antiken Schröpfkopftypus*. Germania. 1882, 60: 513-32].
7. Celsus 2.11
8. Cf. *Diseases of Women* 71.22 and [*Barrenness*] 233.22; Aetius 16.75.28.
9. Cited by ORIBASIUS, *Coll. Med*. 10.19.2 (hysterical suffocation and uterine prolapse). Cf. also AETIUS: 16.24 (removal of the placenta, followed by Paul

6.75.2), 16.34 (promotion of conception), 16.53 (inducing menstruation), 16.71 (prolapse of the uterus), and 16.83.26 (fibroid tumors? [Soranus]).

10. A less well-known relief in private hands clearly shows the interior of the chair; see PHILLIPS E.D., *Aspects of Greek Medicine*. Philadelphia, Charles Press, 1987, Fig. 3. I am dubious as to the authenticity of this relief, but that does not detract from its usefulness as an illustration.
11. For other textual references to and illustrations of the Hippocratic birthing chair, called lãsana, see HANSON A.E., *A Division of Labor: Roles for Men in Greek and Roman Births*. In: BEST, J., DE VRIES, N. (eds), *Thamyris, Mythmaking from Past to Present*. Amsterdam, Najade, 1994, pp. 157-202: esp. 163ff.
12. Especially on the catapult or, as before, on hoisting machines: cf. e.g. MARSDEN E.W., *Greek and Roman Artillery: Historical Development*. Oxford, Clarendon Press, 1969, Fig. 1.21 et passim; SCRANTON R., *Greek Building*. In: ROEBUCK, C., (ed.), *The Muses at Work*. Cambridge, Ma. and London, MIT Press, pp. 2-34, esp. 19.
13. There are occasional references to some of these conditions in Hippocratic texts, thymi, acrochordon and myrmecia, for example, but not in connection with female problems. Cf. *Nutriment* 17 (thymi), *Aph*. 3.26 (acrochordon in old people), and *Use of Liquids* 4, *Diseases* 2.51.5 (myrmecia).
14. CELSUS 1, preface 23.
15. See VON STADEN H., *Herophilus, the Art of Medicine in Early Alexandria*. Cambridge, New York, Cambridge U. Press, p. 365 ff.
16. The *speculum* is deployed in Aetius for: abscess of the womb (16.89; cf. also Paul. 6.73), ulcerated womb (16.101), cancer of the womb (16.106), uterine hemorrhoids (16.109), uterine stone (16.110), uterine thymi, myrmecia and acrochordon (16.117), uterine fissures (16.119), a callous resembling millet grains (16.120), and blockages of the female parts such as imperforate vagina (16.108; cf. also Paul 6.72.1).
17. For the anesthetics available see CAVENAILE R., *L'anesthésie chirurgicale dans l'antiquité Gréco-Romaine*. Medicina nei Secoli 2001; 13,1: 25-46. But these must not always have been administered or, at least, not administered effectively, to judge by references to the sufferings of surgical patients in Celsus 7, Prooemium 4 and St. JOHN CHRYSOSTOM, *On the Paralytic Lowered through the Roof*, PG, 51, col. 55.
18. LYONS A. S., PETRUCELLI R. J., *Die Geschichte der Medizin im Spiegel der Kunst*. Köln, Dumont Buchverlag, 1980.

19. BLIQUEZ L.J., ref. 2, p. 65 and BLIQUEZ L.J, *Gynecology in Pompeii*. In: (eds) VAN DER EIJK PH. J., HORSTMANSHOFF H. F. J., SCHRIJVERS P. H., *Ancient Medicine in its Socio-Cultural Context*. Amsterdam-Atlanta, Ga., Rhodopi, 1995, vol. 1, pp. 209-225. None of the uterine specula are now operational.
20. The relevant chapter (per‹ dioptrismoË) is now missing from the manuscripts, but Muscio's Latin paraphrase exists (II.XXXIV).
21. See DRACHMANN A.G., *The Mechanical Technology of Greek and Roman Antiquity, a Study of the Literary Sources*. Copenhagen, Munksgaard- Madison, University of Wisconsin Press, 1963, pp. 152, 204.
22. This would be the larger of the two. Note that a uterine type was also recovered there; see BLIQUEZ L.J., ref. 2, pp. 65-66.
23. Cf. also the pseudo Aristotelian *Mech*. 854a15 ff.
24. These being mikrÚn diÒptrion and •drodiastoleÊw.
25. By JACKSON R., *Roman bivalve dilators and Celsus' "instrument like a Greek letter-- (De med. VII, 52 B)*. In: SABBAH G. (ed), *Le Latin Médical, La Constitution d'un Langue Scientifique*. Saint-Étienne, Publications de L'université de Saint-Étienne, 1991, pp. 101-108.
26. 90.15: kãtoptron: ≤ mhlvt€w. For the *melotis*, see below and BLIQUEZ L. J., *Roman Surgical Spoon-Probes and their Ancient Names*. Journal of *Roman Archaeology* 2003; 16.1: pp. 322-330, esp. 328.
27. See MINE J.St., ref. 6, p. 81. "Hegar's dilators" take their name from Alfred Hegar, German gynecologist (1830-1914). Hegar's "sign" (softening of the lower uterus in pregnancy) also bears his name.
28. Aetius 16.116.5 (positioning fleshy outgrowth from mouth of uterus for excision), Aetius 16.117.37 (positioning thymi of female genitalia for excision [Philumenus]), Paul 6.71.1 (positioning thymi of female genitalia for excision), Paul 3.75.2 and Moschion 2.30 (positioning uterine hemorrhoids), and Paul 6.80.1 (positioning for excision condylomata). To these we may add Aetius 16.115 and Paul 7.70 for the role of the *mydion* in clitorectomy and the excision of cauda pudendi (a growth of uncertain nature), also operations not attested to in the Hippocratic Corpus. For more on clitorectomy see KNIGHT M., *Curing Cut or Ritual Mutilation*. Isis 2001; 92:317-338. The term *sarkolabon* was also used to designate the Imperial forceps; see Moschion 2.30 (positioning uterine hemorrhoids): *myzo vel sarcolabo haemorrhoides teneantur--*.
29. See JACKSON R., *A Set of Roman Medical Instruments from Italy*. Britannia 1986; 17: 119-167, esp. 123, 137.

30. BLIQUEZ L.J., ref. 2, pp. 58-60, 175-183.
31. Cf. also KUENZL E., ref. 3, pp. 64, 76, 90, 94, 105.
32. Imperial surgeons used the *ankistron* in dealing with hemorrhoid of the womb (Aet.16.109; Celsus 7.30.3B), hydrocele in the womb (Aet. 16.112), and growths interfering with childbirth (Aet. 16.23.14-18). They could also be used as hemostats when they were inserted in blood vessels and twisted around. Soranus asserts that uterine hemorrhages cannot be stopped using this method (*Gyn*. 3.40.2); but this of course means that some physicians did employ such a practice. The function of the *typhlankistron* is discussed below.
33. PSEUDO-DIOSCORIDES, *On Venomous Animals*, 2.32; ORIBASIUS, *Coll. Med*. 45.10.3.
34. See Aetius 16.117 for uterine thymi, myrmekia and acrochordon, 16.23 for embryotomy, 16.100 for uterine fistula, and 16.108 for atresia. Various other conditions which require cutting include hernias like hydrocele, bubonocele and cirsocele. For these surgeries, see below. Growths and abcesses on the breast or female parts needing lancing or excision are also listed by Oribasius at *Coll. Med*. 45.11.4 and *Ecl. Med*. 97.29 & 137.1.
35. Hippocrates, *Diseases* 2.47.63; Galen, *Hippocratic Glossary* 19.120.9-10K (maxair€di sthyoeide›: t“ smil€ƒ fiatrik“ gastr≈dei) and 19.140.14K (sthyoeide›: maxair€ƒ smil€ƒ).
36. For cutting the umbilical cord see Soranus *Gyn*. 2.11.2; Oribasius *Coll. Med. (lib. inc.)* 29.1; Aetius 4.3.3.
37. I was able to trace the specimen in the top row, second from the right, back to the Casa del Medico Nuovo II; the others are from undetermined locations in the city. See BLIQUEZ, L.J., ref. 2, p. 36. Most have now lost their blades but, fortunately, they were still attached when Fig. 6, an old Alinari photo, was made at the end of the 19th century.
38. For the name vase of the Clinic Painter, ca. 460 BCE; see BOARDMAN J., *Athenian Red Figure Vases, The Archaic Period*. Toledo, Thames and Hudson, 1975 (rep. Toledo, Artes Graficas, 1983), p. 195 & Fig. 377. The fact that the surgeon shown grips his “scalpel” at midpoint, so that it protrudes from his hand on the side opposite the blade, is no argument for a dissector of the type common on models of the Empire. A contemporary surgeon also holds his scalpel in this way.
39. In uterine operations we find the polyp knife used to excise kerkosis and thymi (AETIUS, 16.116 and 117 [Philumenus]). Both Aetius (16.89) and Paul (6.73) lance abscess of the womb with the same instrument or with the *katias*, while Paul also deploys the former to puncture the amniotic sack

(3.76). Paul removes growths like thymi, condylomata and hemorrhoids from the female parts by steadying them with a forceps and excising them with the *hemispathion* (6.71). Paul also refers to use of the *syringotomon* in opening imperforate vagina (6.72). For this operation see also Celsus 7.28, though he does not specify the cutting instrument to be used.

40. PAUL (6.25).
41. For example, Soranus, while treating of embryotomy, comfortably refers twice to the *polypikon spathion* as simply *spathion* (*Gyn*. 4.11.3). Another clue is Celsus' description of the knife used to remove nasal polyp as a *ferramentum acuto modo spathae factum* (7.10).
42. The *syringotomon* seems to have assumed several forms. In general it is referred to as "falciform," and various conjectures have been made as to what this meant (see MILNE J.S., ref. 6, pp. 45-46). However, in enlarging a wound through which the intestine and/or omentum have prolapsed with the goal of restoring the protruding part(s) to their proper position, Paul (6.52) recommends straight *syringotoma* (tå kaloÊmena ˆrya suriggotÒma;). That these featured blades sharp only on one side and dull on the point is shown by Paul's source, Galen: "Suitable for this kind of incision are the *syringotoma* called 'straight.' Knives that are double edged or sharp at the point are to be avoided at all costs" (*Method of Healing*, 10.415K). These straight models were very probably the type used for imperforate vagina (see ref. 39).
43. See also MOSCHION 2.33.
44. See MILNE J.S., ref. 6, p. 157.
45. See Aetius 16.23.43 for *smile/smilion*; see Aetius 16.23.43, Paul 6.74 and Soranus, *Gyn*. 4.11.3 & 5 for polyp knife. For *embryotomon*, Soranus, *Gyn*. (4.11.3). Cf. also the narrow (stenÒn; Oribasius, *Coll*. *Med*. 50.9.2) *skolopion/skolopomachairion* (skolopomaxa€rion) for opening the head of an impacted foetus in Paul (6.74) as well as for dismembering a fetus in embryotomy in Aetius (16.23.47 [Philumenus]). This knife was pointed and sharp on one side and dull on another according to Paul (6.6). GALEN (*On Anatomical Procedures*, 2.682K) wants a knife he has made for dissection to be like the *skolopomachairion* and of the finest steel such as Noricum. The blade on Fig. 6, top row, 10th from the right might be the type in question. Whether it is or not, the *skolopomachairion* was probably only a blade inserted in the usual leaf shaped dissector.
46. GALEN, *Hippocratic Glossary*, 19.104.6 and 130.16K. The term *kephalolklastes* must also have been used, as it occurs on later Byzantine lists; see

BLIQUEZ L.J., *Two Lists of Greek Surgical Instruments and the State of Surgery in Byzantine Times*. Dumbarton Oaks Papers 1984; 38: 187-204, esp. 197, 200. Strangely, no surviving post-Hippocratic medical treatise attests to use of the cranioclast or describes its physical appearance. This may be because it was not often deployed. Soranus, for example, simply crushes the head of the embryo with his hand (*Gyn*. 4.11.3). If the head could generally be managed in this efficient and convenient way, that might explain why a special cranioclast was rarely used, hence seldom mentioned in the literature.

47. Soranus (*Gyn*. 4.11.5), Aetius (16.23.45 [Philumenus]) and Paul (6.74) all attest to use of the tooth and bone forceps in breaking down the skull of an impacted embryo.
48. The risks of this operation are rehearsed by LASKARATOS J., LAZARIS D., KREATSAS G., *A Tragic Case of Complicated Labour in early Byzantium (404 A.D.)*. European Journal of Obstetrics and Gynecology and Reproductive Biology 2002; 105: pp. 80-83.
49. Only Celsus says anything about the form of the hook, which he refers to as an *uncus* (7.29.4). He says that it should be "everywhere smooth and with a short point" (*undique laevis, acuminis brevis*).
50. BLIQUEZ L.J, ref. 19.
51. MEYER-STEINEG T., *Chirurgische Instrumente des Altertums*. Jena, Gustav Fischer, 1912, p.37 and Taf. VI, 1.
52. ZIMMERMANN S., KUENZL E., *Die Antiken der Sammlung Meyer-Steineg in Jena*, Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz, 1991, 38: pp. 515-540 and Taff. 40-53, see esp. p. 522 and Taf. 26.
53. Though it is sometimes held that this forceps came from Herculaneum, I am convinced that it was recovered in Pompeii; see BLIQUEZ L.J., ref. 2, p. 60. For a complete treatment of the *ostagra* see KUENZL E., WEBER T., *Das spätantike Grab eines Zahnarztes zu Gadara in der Dekapolis*. Damaszener Mitteilungen, 1991, 5: pp. 81-118, esp. 102-115 and Taff. 36-39.
54. Likewise in dealing with this situation we once find an equally risky non-surgical method: in this case a wool wrapped Ñrabd€on or "rod" to administer black hellebore to expel a dead fetus, perhaps in an earlier phase of pregnancy (*Diseases of Women* 91.18).
55. 70.25: tÚ maxa€rion---kampul≈teron ¶stv µ fiyÊteron.
56. 19.104.6 and 130.16K.
57. ¶xein d¢ xrØ prÚw tå toiaËta ka‹ ˆnuxa §p‹ t“ daktÊlƒ t“ megãlƒ. Tertullian may also mention the instrument, apparently (reading disputed) calling it an *anuloculter* in *De Anima* (25.4-6), a passage, which

treats abortion of an impacted embryo as a necessary act of cruelty. As he specifically mentions Hippocrates in the course of treating abortion and the instruments used, Tertullian most likely has the *onyx* of *Superfetation* in mind. There exists no surviving specimen from any period of Greco-Roman antiquity.

58. sidÆrion ÙjÁ prosdhsãmenow prÚw tÚn dãktulon tr∞sai.
59. For information about these pieces see BLIQUEZ L.J., ref. 2, pp. 44-46 and KUENZL E. ref. 3, pp. 25-27, 47.
60. For these types see JACKSON R., ref. 29, 126-128, 151-156.
61. Gunaik‹, §n ÉAbdÆroisi, kark€nvma §g°neto per‹ tÚ st∞yow, ka‹ diå t∞w yhl∞w ¶r=een fixΔr Ïfaimow: §pilhfye€shw d¢ t∞w =Êsiow, ¶yanen.
62. This is not to say that cancer itself never was treated surgically by Hippocratics. *Aphorisms* 6.38 may allow for surgical intervention for hidden as opposed to ulcerous cancers in the classical period: "It is better not to treat those with hidden cancers. They die quickly when treated; whereas they last a long time if left alone." We do not know where the cancers attested to in this aphorism lay, but the author's opposition to treating them at all shows that others did not favor his views. Cf. *Prorrhetic* 2.11 for the sentiment that old people are prone to superficial and hidden cancers.
63. 16.71: ka‹ går ka‹ ˜lhn éfairey∞nai mÆtran diasape›san flstore›tai, ka‹ z∞sai tØn guna›ka.
64. Aetius is the sole source for Aspasia. For the vexed question who Aspasia might have been see FASBENDE H., *Geschichte der Geburtshülfe*. Jena, Fischer, 1906, pp. 60-61.
65. KUENZL E., *Eine Spezialität römischer Chirurgie: die Lithotomie*. Archaeologisches Korrespondenzblatt 1983; 13: pp. 487-493.
66. See JONES W.H.S, *Hippocrates, Works*. Loeb edition, vol. 1, London, Cambridge Ma., Harvard U. Press, 1923 (rep. 1957), p. 296.
67. For Imperial specialization see especially Galen (*Thrasybulus: Whether Health is the Province of Medicine or Gymnastics, 5*.846-847K) and the Arabic version of *On the Parts of the Medical Art*; for which see LYONS M. C., *Galen, On the Parts of Medicine; on Cohesive Causes; on Regimen in Acute Diseases in Accordance with the Theories of Hippocrates*. Berlin, Akademie-Verlag, 1969, p. 29.
68. BLIQUEZ L.J., ref. 2, pp. 55, 79-80.
69. We encounter dilation via a series of probes twice more in similar language in recommendations for promoting conception (*Diseases of Women* 217.23-39; *Superfetation* 29.22-39). And we hear again of the same procedure at

Diseases of Women 221.9-18 where, however, the number of probes to be inserted is given as precisely five.

70. For Roman reliefs showing instruments for sale, see KRUG A., *Das Berliner Arztrelief*. Winkelmannsprogram Der Archäologischen Gesellschaft zu Berlin, 142, Berlin, Walter de Gruyter, 2008. For an actual shop in Pompeii where instruments have been found see BLIQUEZ L.J. ref. 2, p 83.
71. For the names and complete functions of these tools see BLIQUEZ L.J. ref. 26. The probes of interest in Fig. 6 are the spoons and spatulas equipped at their opposite terminus with the enlargement called *pyren* in the middle and bottom rows.
72. On this point see CELSUS (7.26.1a-1c.1), AETIUS (11.5.83), and PAUL (6.59). Rufus of Ephesus links shape of the male model to the collarbone (*On Bones* 12). Galen several times refers to wide bored models (*Method of Healing* 10.328 and 337K).
73. See WELLMANN M., RE, s.v. "Erasistratus;" GURLT E., ref. 1, vol. one, zweiter Buch, p. 309.
74. We hear, for example, from Imperial sources that the catheter could be employed to thrust a stone lodged in the neck of the bladder back into the bladder itself (RUFUS, *Diseases of Kidney and Bladder* 15.3.2; SORANUS, *Gyn*. 4.7.8), and Galen in one instance uses the catheter for breaking through scar tissue blocking the urinary passage (*On Affected Places* 8.11K). Similarly, Oribasius, who follows Antyllus and Heliodorus, inserts the catheter to position and guard the neck of the bladder when incising a fistula (*Coll. Med*., 44. 20.63). And Caelius Aurelianus seems to connect Erasistratus himself with innovation in the use of the catheter when he remarks, "Besides, when the peritoneum is paralyzed, as Erasistratus says, the urine is held back and is not voided unless you introduce a catheter" (*Chronic Diseases* 2.2.13).
75. See also ORIBASIUS, *Syn. ad Eust*. 9.55.1.
76. MAJNO G., *The Healing Hand*. Cambridge/Mass., London, Harvard University Press, 1975, p. 328. Hippocratics are not quite as inept at amputation as he makes out. See also GURLT E., ref. 1, vol. one, zweiter Buch, p. 293.
77. xr∞syai d¢ xrØ afie‹ toÊtoisi ì ín tÊx˙ pareÒnta.

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