BIOPHYSICAL SEMEIOTIC DIAGNOSIS OF ACUTE APPENDICITIS . BERTI-RIBOLI'S SIGN* AND BELLA'S SIGN.**

Sergio Stagnaro
Via Erasmo Piaggio, 23/8 – Riva Trigoso - Genova
email dottsergio@semeioticabiofisica.it

Simone Caramel
Via Doberdò, 3 – Fontane di Villorba - Treviso
email simonecaramel@yahoo.it

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Introduction.

In former articles about acute appendicitis diagnosis, the Authors constantly ignore the clinical diagnosis made with the aid of auscultatory percussion, for the first time described in 1987 (5) (See: Infotrieve, Medline, Medscape, http://digilander.libero.it/piazzetta.sfera.net, www.katamed.it, my Page), which recently was enriched by numerous signs, collected at the bed-side by means of the Biophysical Semeiotics (1,2,3,6), method of investigation based chiefly on auscultatory percussion, and completely described as follows.

Because of the *insufficient* reliability of the traditional physical semeiotics and since the classic history of anorexia and periumbilical pain, followed by right lower quadrant pain and vomiting, is present in fewer than 60% of cases, 30% of surgical operations are made, unfortunately, on healthy appendix [does it really exsist the *white appendicitis*?] and surely a larger percentage regards late operations.

Really, at least in some cases, there is neuroproliferation in the appendix, in association with an increase in cytochines and neurotransmitters SP and VIP; this event may be involved in the pathophysiology of acute right abdominal pain in the absence of an acute inflammation of the appendix (8). In my opinion, due to the relation between neurologic system and immunological system (See Oncological Terrrain in my site HONCode 233736 www.semeioticabiofisica.it) it is possible the existence of *neuroappendicitis.*

Biophysical Semeiotics, based on auscultatory percussion, auscultatory percussion reflex-diagnostics, and on the use of mathematical models of non-linear physics allows doctor to recognise rapidly as well as easily a large number of signs, among them **tonic Gastric Contrection Sign** (**tGC**), **Berti-Riboli's Sign, and Bella's Sign,** present in 100% of the cases, regardless the location and the severity of appendicitis, as a 45-year-long clinical experience permits me to state (1-6).

Furthermore, due to the recent discover of Brain Sensor Bedside Evaluation – BSBE (25), the physicians can follow the following path:

A) if BSBE is positive, and Gandolfo's Sign is negative than there is something pathological;
B) If Stagnaro's Sign is positive (26) than the cause is in the digestive system;

C) The physicians assess aspecific signs of acute inflammation (there is an inflammatory cause and nothing more);
D) Assessment of specific signs of Appendicitis, as explain in this article.

Biophysical-semeiotic diagnosis of the appendicitis. Tonic Gastric Contraction, Berti-Riboli's, and Bella's signs.

Tonic Gastric Contraction (tGC) permits by itself to evaluate both the presence and the seriousness of appendicitis, i.e. therapeutic monitoring, performed also with the aid of other numerous biophysical semeiotic signs, which are divided in "common" – inflammation signs observed in all processes, infective, connectival, tumoural in origin – and "specific" , i.e. present exclusively in the appendicitis (1,2,3,5).

Among other important signs of inflammation, I remember at first the **Rethiculo-Endothelial System Hyperfunction Syndrome (RESHS),** now known as Monocytes-Macrophages System (2,3), **Acute Antibodies Synthesis Syndrom** (AASS), and the increase of **Acute Phase Proteins** production (4,5) (See in my above-cited site, Practical Applications).

RESHS corresponds to the ESR raising and to altered proteins electrophoresis, but is of both more sensitive as well as specific (1,2,3,6). To detect these signs and syndromes, from the technical viw-point, doctor has to know only the Auscultatory Percussion of the stomach (Fig.1), really easy to perform, described even in the *classic* text-books , such as ***Rasario***, IX edition.

At this point, in the interest of reader, who is not yet skilled of biophysical semeiotic technique, in the following I refer particularly some signs, which doctor can easily observe at the bed-side by auscultatory percussion evaluation of the stomach.

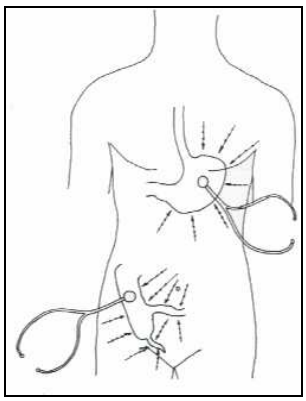

Fig. 1

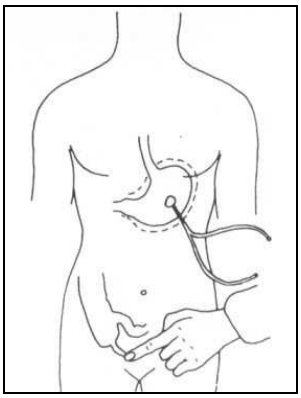

Fig. 2

In practice, a short segment of stomach great curvature in its lower part, as indicated in Fig.1 (arrows upwards), is detected, useful in ascertaining some important, above-describred signs, unavoidable to recognize the appendicitis: with the bell-piece of sthetoscope (bps) properly located – a patient's finger fixes the bps – doctor applies digital percussion as usually, i.e. with middle finger slightly bended, functioning as "a little hammer", *directly* and *gently* (i.e. with slight intensity) on the skin, two times on the same point, moving than towards the bell piece of stethoscope, along radial and centripetal lines, starting from te umbelical horizontal line.

When digital percussion is applied "directly" on cutaneous projection area of the stomach (or of whatever viscera, e.g. caecum), percussion sound is perceived clearly modified, hyperfonetic, and "it seems to originate near to the doctor's ears" (5).

In healthy, the reflex lasts > 3 sec. < 4 sec. and, then, disappears lasting for a short time: disappearing time (disappearing time = fractal dimension of the deterministic chaos of local microvessels fluctuations evaluated in more sophysticated manner: 3,81) (4, 7).

The doctor evaluates the **RESHS** by the aid of digital pressure of "mean" intensity applied on the median line of sternal (breast-bone) body, iliac crests and cutaneous projection area of the spleen: in healty individual, after a latency time (lt) of **10 sec. exactly**, both fundus and body of the stomach dilate – **1-2 cm.** – whereas antro-pyloric region contracts (Fig.2) (**gastric aspecific reflex, vagal type**) (See: Technical Page N° 1, in Home-Page).

On the contrary, in whatever infectious (caused by Gram +) as well as connective disorder, malignant tumour, a.s.o., lt appears lower than normal, i.e. **6 sec.** (**3** sec. in case of *cancer*, apart from the initial stages), in relation to the degree of disorder, and dilation is > **2 cm.**: **RESHS "complete"**.

As a matter of facts, there are two other types of this syndrome: **a) RESHS "incomplete"**, characteristic of flu: spleen does not synthesize *acutely* antibodies (where lt of spleen-gastric aspecifix reflex is **3 sec.** *during slight digital pressure*), consequently pressure of "mean" intensity on spleen projection area cannot bring about the gastric aspecific reflex after *pathological* lt; **b) RESHS "intermediate"** is typically present in case of infectious diseases, caused by bacteria Gram -, as *E.coli* e *H.pylori*, characterized by the fact that gastric aspecific reflex is clearly *less intense* when digital pressure stimulates splenic *trigger-points*. In other words, in case of Gram- infections, splenic-gastric aspecific reflex is present, but "smaller" than breast-bone or iliac crests-gastric aspecific reflex, allowing doctor to recognize at the bed-side the real nature of bacteriological agents, causing the disease. The reduction of spleen antibodies synthesis accounts for the reason that the **RESHS** is termed **"intermediate"**.

In very initial stages of whatever disorder, if this syndrome appears to be negative, doctor has to evaluate **RESHS** in a "sensitive" manner, i.e. with *boxer's test*, *apnea test*, *Restano's manoeuvre* (= the two tests are simultaneously applied), lasting roughly **10 sec.** (sympathetic hypertone): after **3 sec.** a gastric aspecific reflex appears, **≥ 2 cm** in intensity, with a reinforcing after **< 9sec.** (NN: **1 cm.** and reinforcing lt **≥ 9 sec.**, respectively) (See. Glossario in Home-Page).

The **Antibodies Synthesis Syndrome** (**ASS**) can be easily ascertained by means of gastric aspecific reflex, caused by "*slight*" digital pressure, applied on whatever MALT (*mucose associated lymphatic tissue*) site, e.g. on cutaneous projection area of the liver, appendix, breast, anterior thorax wall, along mean clavicular line (BALT), on spleen (except for flu), a.s.o.: in healthy, lt is **6** sec. exactly and intensity 1-2 cm.: **ASS type chronic.** On the contrary, in case of acute appendicitis, lt drops to **3** sec. exactly and the reflex intensity is > **2 cm.**: **ASS type acute**.

Interestingly, a diseased appendix *does not* synthesize antibodies at all; therefore, are locally absent both **ASS acute** and **chronic.** Identical behaviour show all other biological systems, which physiologically synthetize antibodies: in case of wathever local disorder, regional antibodies synthesis appears interrupted. For instance, in a *breast involved by cancer, even in initial stage*, acute type of **ASS is** locally **absent**, at least in the precise area of the tumour. (I can not describe "here and now" interesting modifications of the *microcirculation* in cancer, due to technical lack of reader's knowledge).

At this point, in order to recognize and "quantitatively" evaluate the **tGC Sign** doctor applies digital pressure on appendix cutaneous projection, possibly localized by auscultatory percussion; after a latency time ≤ **6 sec. (NN = 10 sec.)**, digital pressure brings about intense gastric aspecific reflex, followed by **tGC.**

Thereafter, doctor asks the patient "to press down its abdomen as to evacuate" (*simulated evacuation test*); practically patient is invited to carry out Valsalva's manoeuvre, that causes the same sign – **Berti-Riboli's Sign** – likely when physician (the manoeuvre is most refined) applies digital pressure precisely on cutaneous projection area of the inflammed appendix, previously localized by means of auscultatory percussion (Fig.2): immediatly (1-3 sec.) stomach dilates (i.e.

the gastric aspecific reflex suddenly appears), then, after **3 sec. precisely**, stomach contracts rapidly in intense manner: **TGC Sign** of **≥ 2 cm.** (3,6) (Fig.2).

In healty individual, in identical condition, gastric aspecific reflex lt is **10 sec.**, duration **> 5 sec.** and, finally, **TGC < 2cm.**

In case of *retrocaecal appendicitis*, until now really difficult to recognize clinically with the aid of old, accademic, physical semeiotics, the patient bends its stretced right leg towards abdomen: the "spontaneous" **TGC** suddenly appears (100% of cases), after a gastric aspecific reflex with **1-2 lt** and lasting once more **3 sec.**: **Bella's Sign** "classic" (**Bella's Sign** "variant": patient bends the left leg in identical manner as described above, with the same results in case of appendix located in left ileo-pelvic region).

In healthy, in identical above-described conditions, lt of gastric aspecific reflex is **10 sec.**, duration **>5 sec.** and **TGC** intensity is **< 2 cm.** Interestingly, the degrees of reflexes paramaters are the same in both signs, pointing out internal and external coherence of biophysical semeiotic theory.

As regards the evaluation of **Acute Phase Proteins,** completely described in my above-cited site, it is sufficient to stimulate hepatic trigger-point by a finger-nail and assess the *patological* hepato-gastric aspecific reflex, absent in healthy, showing a latency time of **3 sec.,** which becomes greater untill disappears when appendicitis ameliorates as far as the *restitutio ad integrum*.

BIOPHYSICAL-SEMEIOTIC SIGNS OF APPENDICITIS

"COMPLETE" RESHS
ACUTE PHASE PROTEINS AND OTHER SIGNS OF INFLAMMATION ANTIBODY SYNTHESIS ACUTE SYNDROME
BERTI-RIBOLI'S SIGN
DI BELLA'S SIGN
APPENDIX ENLARGEMENT
ABSENCE OF PHYSIOLOGICAL PERISTALSIS
CLINICAL MICROANGIOLOGICAL SIGNS

Tab.1

Clinical microangiology of acute appendicitis.

Other numerous biophysical semeiotic signs (detectable by doctor skilled of the new method) and described in earlier articles (16-22), are illustrated in following.

Auscultatory percussion, accurately performed, allows doctor to recognize the increase, even small, of **appendix transverse diameter**: **≥ 1 cm.** (NN = 0,5 cm.), due to edema-infiltration-endoluminal effusion. Contemporaneously, physiological **appendicular peristalsis** *is absent*: in healthy, every 18 sec. one can observe, with the aid of auscultatory percussion, a wave moving from a pace-maker localised at the bottom of viscera as far as to its meatus.

In a 45-year-long bed-side experience, infact, clinical-microangiological signs proved to be really essential in corroborating appendicitis diagnosis, made on the base of above-described signs (Tab.1), so that in folowing they are illustrated in detail.

From the practical point of view it is sufficient and reliable to evaluate periods as well as intensity of low ureteral reflex oscillation (= vasomotion), for example, during mean digital pressure, applied upon the middle third of biceps muscle, compressing it between thumb and other fingers, of a supine individual, psychophysically relaxed. The pressure on whatever scheletric muscle (e.g. biceps muscle between the thumb and the other fingers) allows doctor to examine resistance microvessels dynamics and flowmotion along nutritional capillaries.

However, the original morphological analysis of vasomotion, i.e., the precise evaluation of low ureteral reflex oscillations, interestingly reveals the actual condition of related tissue-micro vascular-units, in a synergetic model. In order to realize this analysis, it is unavoidable to transfer upon Cartesian coordinates intensity (ordinate, cm) and duration (abscisse, sec.) of three successive fluctuations of low ureteral reflex, observed, for example, in the above-mentioned situation, during biceps muscle microvascular units stimulation.

In healthy, we observe a characteristic diagram (Fig. 3).

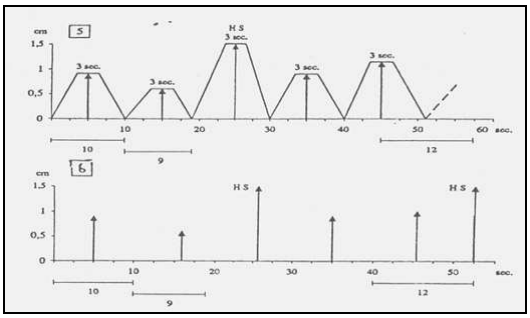

Fig. 3

Interestingly, in 3 sec (ascending line: AL in Fig.4) oscillation reaches its highest intensity (normal intensity is varying from 0,5 to1,5 cm); the "plateau" line (PL) lasts physiologically 3 sec, then in 1 sec (descending line: DL) the line returns to the basal value (i.e. abscisse), where persists for 2-5 sec, varying the periods from 9 to 12 seconds under physiological conditions.

On the contrary, in pathological situations, e.g. **essential hypertension**, the diagram results interestingly modified (Fig.4): AL as well as DL are normal, 3 sec. and 1 sec respectively; intensity is approximately 0,5 cm, in a "predictable" manner; the physiological highest waves, i.e. highest spikes of 1.5 cm intensity (HS), are absent.

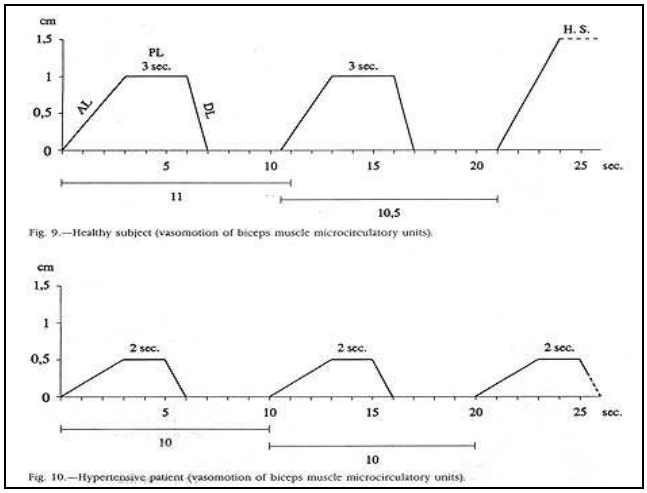

Fig.4

Finally, in case of **hyperfunctioning tissues**, e.g. the bone-marrow during infective disorders of whatever nature, digital pressure upon the middle line of breast bone, brings about low ureteral reflex oscillations, characterized by PL of 5 or more sec, intensity as well as periods practically identical each other (Fig. 5). Intensity and PL of every oscillation are directly correlated: more high the intensity, more prolonged appears PL and consequently more efficacious is the flow-motion of related nutritional capillaries.

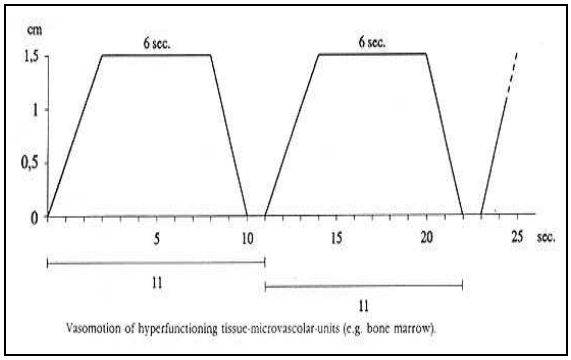

Fig. 5

This clinical evidence underlines the inner consistence of **Biophysical Semeiotics**.

In addition, superimposing the parameters of three subsequent oscillations of low ureteral reflex, in accordance with the lenght of single period, we realize really interesting figures. In healthy people the obtained area shows a "strange" shape, like a "strange" attractor (Fig. 6): fractal dimension (fD) >3 (16-19), that corresponds to the space occupied by a fractal structure.

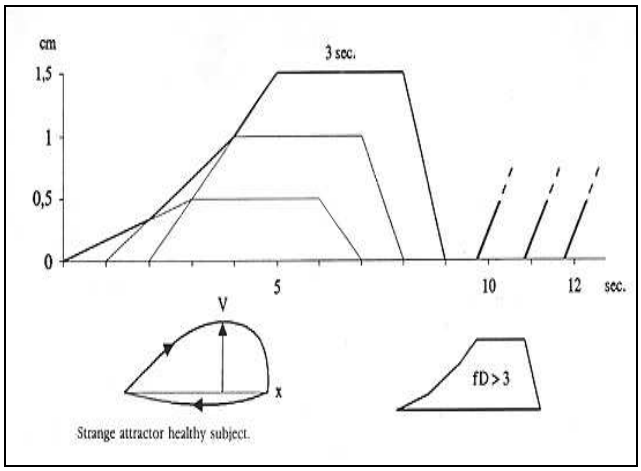

Fig. 6

Strange attractor: healthy subject.

On the contrary, under pathological condition, e.g. essential hypertension as far as biceps muscle microcirculatory bed is concerned, the area obtained in this manner appears quite small, resembling an attractor at fixed point (Fig. 7).

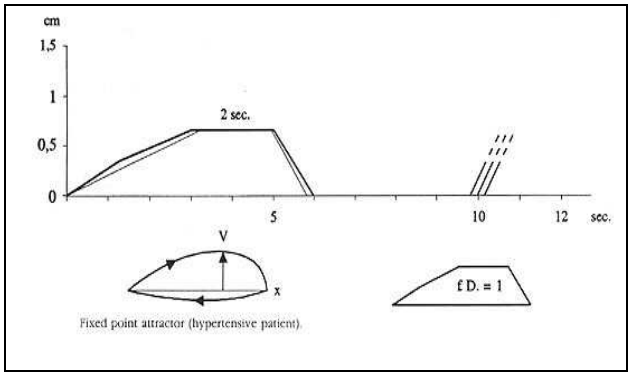

Fig. 7

Fixed point attractor: hypertensive patient

Finally, the area corresponding to hyperfunctioning microcirculatory units results the largest one, due exclusively to its large Euclidean perimeter; its shape, however, resembles clearly a deformed circle, corresponding to a "closed loop" attractor (Fig. 8) (23, 24).

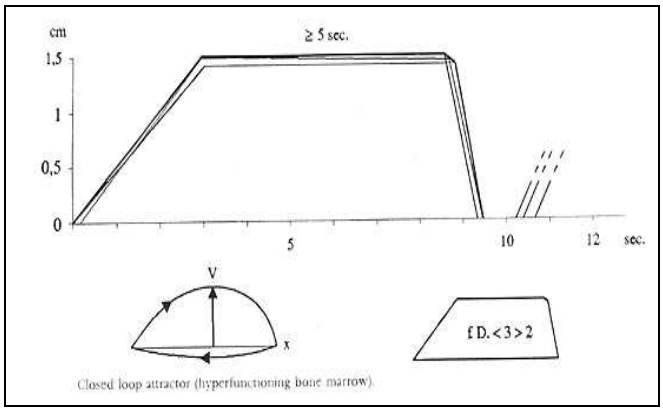

Fig. 8

Closed loop attractor in hyperfunctioning bone-marrow.

From the above remarks it results that morphological analysis of vasomotion, by means of **Biophysical Semeiotics**, in physiological as well as in pathological conditions, represents an original, reliable and usefull tool in clinics, research, and therapeutic monitoring, as allows me to state a long, well established experience. (For further information on this topic, See my site www.semeioticabiofisica.it/microangiologia).

Discussion.

The general practitioner, who knows **Biophysical Semeiotic** in a *safe*, satisfactory manner, certainly is able to diagnose, promptly and clinically, the appendicitis, regardless of its clinical phenomenology, seriousness of the disease or site of appendix, even with the above-described signs.

A long, well established experience allows me to state that, by means of **Biophysical Semeiotics,** the diagnosis of appendicitis is *a clinical one*. Unfortunately, now-a-days bed-side

diagnosing appendicitis is still often difficult and actually this fact accounts for the reason that a large number of patients are operated to late.

In fact, although acute appendicitis is the most common disease of the appendix, other potential pathologic conditions affecting the appendix include swallowed foreign bodies, pinworms, fecaliths, carcinoids, cancer, villous adenomas, and diverticula. The appendix may also be involved in idiopathic ulcerative colitis or the ileocolitis of Crohn's disease (15).

Except for hernia, acute appendicitis is the most common cause in the USA of an attack of severe, acute abdominal pain that requires abdominal operation. Because symptoms and signs vary widely and because delay before operation is so hazardous, it is accepted that nearly 15% of operations for acute appendicitis lead to other findings at laparotomy or even to findings of no disease.

Acute appendicitis is common, but its aetiology remains "vague and indefinite" (8). The causes of appendicitis are not well understood, but it is believed to occur as a result of one or more of these factors: an obstruction within the appendix, the development of an ulceration (an abnormal change in tissue accompanied by the death of cells) within the appendix, and the invasion of bacteria.

Under these conditions, bacteria may multiply within the appendix. The appendix may become swollen and filled with pus (a fluid formed in infected tissue, consisting of while blood cells and cellular debris), and may eventually rupture. Signs of rupture include the presence of symptoms for more than 24 hours, a fever, a high white blood cell count, and a fast heart rate.

However, skilled doctor knows very well that the disease in a large number of cases goes on in a really different way: clinical phenomenology appears difficult and surely not useful in bed-side diagnosing appendicitis.

In the latter part of the 19th century, an eminent text noted that it had become quite common in "highly civilized countries such as Great Britain", with lower occurrence rates in Denmark and Sweden (9). A perforated appendix found in an Egyptian mummy, however, indicates that the disease has been around since ancient times (10).

Originally known as perityphlitis (Greek; *peri*, around + *typhlos*, blind + *-itis*, inflammation), the disease was described by John Hunter in a case at autopsy in 1769 (10); the first use of "appendicitis" is credited to Fitz, who used the term at the inaugural meeting of the Association of American Physicians in 1886 (10).

One of the earliest aetiological theories for acute appendicitis (to which our mothers still subscribe) is that a small foreign body, such as a seed, might lodge in the appendix, thus initiating an acute inflammatory reaction (11). Such as cause of appendicitis is surely possible, but really rare (12).

In 70% of patients with acute appendicitis, the diagnosis is made clinically based on classic signs and symptoms. In the remaining 30% of patients with uncertain clinical findings, radiologic imaging is needed to establish the diagnosis, obviously if doctor ignores the **Biophysical Semeiotics**. Both graded compression sonography or CT can be utilized, when it is possible, of course, to evaluate patients with suspected appendicitis, but certainly not on large scale. Advantages with sonography include lower cost and real-time observation of bowel peristalsis, which can be evaluated by means of the original physic semeiotics. Ultrasound is also superior to CT in diagnosing gynecologic diseases which may mimic appendicitis: as well known **Biophysical Semeiotics** allows doctors to proceed without doubt in the differential diagnosis. CT is performed in patients with marked obesity, tense ascites or severe pain in whom sonography may be technically difficult or non-diagnostic. CT is also preferred in patients likely to have an abscess (13). Every doctor, particularly if general practitioner, knows that at the bed-side such sophysticated semeiotics are not to be utilized at all.

Sonographic criteria for acute appendicitis include a noncompressible appendix with an outer AP diameter of at least 7 mm, mural thickness of 3 mm or greater, or presence of an appendicolith in an appendix of any size. Presence of a hypoechoic fluid collection containing an appendicolith or a fluid collection adjacent to a gangrenous appendix is diagnostic of a

periappendiceal abscess. Percutaneous drainage of large periappendiceal abscesses prior to appendectomy can be performed under both CT or ultrasound guidance.

In experienced hands, graded compression sonography has a greater than 90% accuracy for diagnosing acute appendicitis, surely less than the accuracy of the sign of Gastric tonic Contraction. False-negative diagnoses may occur in retrocecal appendicitis, perforated appendicitis or in pregnant patients, when **Biophysical Semeiotics** permitts easily to recognize appendicitis, even retrocecal and in pregnant woman. False-positive results may be seen in women with a dilated fallopian tube or in inflammatory conditions such as tubo-ovarian abscess or Crohn's disease, which may secondarily affect the appendix.

The majority of patients imaged for right lower quadrant pain do not have acute appendicitis. In up to 70% of these patients, sonography may detect alternative diagnoses such as salpingitis, Crohn's disease, bowel obstruction, ureteral calculi or degenerating uterine leiomyomas, that is, diagnoses correctly made with properly applyied **Biophysical Semeiotics** (1, 3, 5) (See above-cited site).

Researchers have developed a more accurate method of diagnosing appendicitis that may spare thousands of children who develop the potentially fatal problem unnecessary pain and complications, if doctor is ot skilled of **Biophysical Semeiotics**. A new study documents for the first time in children the diagnostic accuracy of a technique known as computerized tomography with rectal contrast (CTRC), a procedure that uses computerized enhancements of X-ray images (14).

Conclusion.

A careful examination, possibly with the aid of **Biophysical Semeiotics**, of course, is the best way to diagnose appendicitis. It is often difficult, infact, even for experienced physicians to distinguish the symptoms of appendicitis from those of other abdominal disorders only by means of the traditional, acàdemic, physical semeiotics. Therefore, very specific questioning and a thorough biophysical-semeiotic examination are crucial. The physician, at first, should ask questions, such as where the pain is centered, whether the pain has shifted, and where the pain began. Soon thereafter, the physician should press on the abdomen to judge the location of the pain and the degree of tenderness. However, of essential importance it is to evaluate the above-described biophysical-semeiotic signs.

The typical and classical sequence of symptoms, in fact, is present in about 50% of cases. In the other half of cases, however, less typical patterns may be seen, especially in pregnant women, older patients, and infants. In pregnant women, appendicitis is easily masked by the frequent occurrence of mild abdominal pain and nausea from other causes. Elderly patients may feel less pain and tenderness than most patients, thereby delaying diagnosis and treatment, and leading to rupture in 30% of cases. Infants and young children often have diarrhea, vomiting, and fever in addition to pain.

The correct and carefull performance of **Biophysical Semeiotics** allows doctor to make the proper diagnosis in “every” case of appendicitis, a part from location, severity, clinical phenomenology, a.s.o.

While laboratory tests cannot establish the diagnosis, an increased white cell count, often absent, may point to appendicitis. Urinalysis may help to rule out a urinary tract infection that can mimic appendicitis for doctor who ignores the new, original physical semeiotics, of course.

Under these conditions, patients whose symptoms and physical examination are compatible with a diagnosis of acute appendicitis are usually taken immediately to surgery, where a laparotomy (surgical exploration of the abdomen) is done to confirm the diagnosis. Often, without the aid of the new physical semeiotics, the diagnosis is not certain until an operation is done. To avoid a ruptured appendix, surgery may be recommended without delay if the symptoms point clearly to appendicitis and diagnosis is corroborated by the original semeiotics (1-4).

Now-a-days there would be no possibility that, as in the past years in case of appendicitis was strongly suspected in a woman of child-bearing age, a diagnostic laparoscopy (an examination of the interior of the abdomen) was sometimes recommended before the appendectomy in order to be sure that a gynecological problem, such as a ruptured ovarian cyst, was not causing the pain.

As regards sophysticated semeiotics, a part from their limited use in bed-side diagnosing appendicitis, particularly by general pratitioners, they show limited sensitivity, as continuous research of new tool demonstrates.

Now-a-days, all around the world, physician skilled of **Biophysical Semeiotics** is able to recognize "whatever" appendicitis, regardless its location, clinical symptomatology, and seriousness, evaluate its severity, and in case monitor it over the time, so that a normal appendix is not jet discovered, as in the last years, in about 10-20% of patients who undergo laparotomy, because of suspected appendicitis.

In conclusion, my 45-years-long clinical experience allows me to state that the diagnosis of acute appendicitis is a "clinical" diagnosis, regardless location of appendix and seriousness of disease.

* Prof. Edoardo Berti-Riboli, docente di Semeiotica Chirurgica, Università di Genova.
**Luigi Bella, Assistente di Semeiotica Chirurgica, Università di Genova,
as a token of my friendship and esteem.

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