

Colonoscopy and colonography: back to the roots

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Abstract. – “Colonoscopy” and “colonography” refer to the endoscopic and radiological examination of the colon respectively. Medical terminology constructs words using original roots from the source languages, which are often Greek or Latin. The word root is the fundamental portion of the term. Multiplication of modern tests and procedures has led to confusion in the application of word roots in medical terminology. This short review (1) analyzes, (2) challenges the established terms “colonoscopy” and “colonography”, and (3) proposes a wording adherent to the rules of terminology in order to avoid confusion.

Key Words:

Colonoscopy, Coloscopy, Colonography, Colography, Terminology.

Medical terminology devises terms which describe the human body and all diseases, conditions, procedures and any other processes related to it. Word construction in medical terminology is based on a systematic approach which uses the concepts of etymology, word roots, prefixes and suffixes.

The *word root* is the fundamental part of word building. This word root is derived from a source language, most often Greek and Latin, which are the mother languages of the western civilization. Using the word root as the foundation, combinations or additions can be used to create new terms, conveying the appropriate meaning. A logical process disciplined to language rules ap-

plies to creating medical terminology. The term created needs also to be suitable to a modern language, e.g. English, especially in the way of pronunciation or phonetics.

The word *gastroenterology* is an example of word composition. This word consists of three Greek components: *ή γαστήρ (gaster, stomach)*, *τό έντερον (enteron, gut)*, and *ό λόγος (logos, study)*, seamlessly combined to convey the meaning of the “study of the stomach and the gut”. Similarly, *cardiology (καρδιολογία)* refers to the study of the heart (*ή καρδιά: cardia, heart; ό λόγος: logos, study*).

Medical terminology has respected and maintained over the centuries the rules of the source language. However, as new procedures or tests continue to rapidly develop, some violations have taken place. For example, *colonoscopy* is the popular term used to describe the endoscopic examination of the colon¹⁻³. This is also occasionally referred to as *coloscopy*^{4,5}. The radiological study of the colon that non-invasively screens for colorectal cancer is referred to both as *colography*^{6,7} and *colonography*⁸⁻¹⁰. As some of these terms are constructed violating rules of linguistics, we feel the rules for formulating the terminology should be clarified and that the correct version of each term should be established.

The compound word *colonoscopy* consists of the Greek words *τό κόλον (colon, also known as τό έντερον: enteron)*, and *σκοπία (scopia, or σκόπησις, scopesis)*. The second word *scopia* is used correctly but it derives from the verb *σκοπέω (scopeo, hence scope)* which literally means *to observe or examine with the eye or the mind*.

The word *colon* in its original form is *κόλον* and simply means *the gut*. Another potentially

confusing word exists in Greek: *κλωνός* (*colonos*), which translates to *a hill*. In the word *κόλον*, that pertains to the gut, *κόλ-* (*col-*) is the root of the word and “-ον” (“-on”) is the disposable ending¹¹. For the purpose of word construction, the decisive factor in all cases is the last letter of the root, i.e. in this case the “λ” in *κόλ-* (“l” in *col*)¹². This last letter is called the *character*^{11,12}. If the character of the root is a *consonant* (e.g. lambda) and the next word to be added to the root also begins with a consonant (e.g. “σ” or sigma, whose English equivalent is the letter “s”), the Greek grammar rules dictate that a vowel needs to be introduced between the two words. A vowel is added in order to achieve a fluent, musical sound, since the pronunciation of sequential consonants in the Greek language is regarded as cumbersome and awkward-sounding, as it might be in English too.

Based on the above rules of Greek grammar, combining the root *κόλ-* (*col-*) with *σκοπία* (*scopia*) would theoretically give rise to *κολσκοπία* (*colscopia*). The “λσ” (“ls”) sound is phonetically cumbersome and therefore the vowel “ο” is added to the root to create *κολ-ο-σκοπία* (*col-o-scopia*, i.e. *coloscopy*). A single “ο” sound is enough to create a meaningful, compound word. The introduction of the sound “ονο” (“ono” in English) to create *κολ-ονο-σκοπία* (*col-ono-scopia*) is superfluous and meaningless, both grammatically as well as semantically (literally meaning “examination of the hill”!).

In the terms *colonography* and *colography*, the word -γραφία (*graphia*, *graphic visualization*) derives from the verb *γράφω*. In combination with *κόλον* (*col-on*, meaning *the gut*), the compound term is *colgraphy*, and with the addition of a phonetic “ο” to eliminate the difficult sound “λγ” or “lg”, this becomes *col-o-graphy*. To create the term *colonography*, the root of the word *colon-os* (meaning *hill*) would have to be employed, rendering the combination meaningless and incorrect.

By application of exactly the same principles based on the word root, we use in medical terminology the correct compound terms *pharmacology* (not *pharmacoonology*) and *neurology* (not *neuronology*). Similarly, the correct compound terms *col-o-stomy* (not *colonostomy*), *col-o-vesical* fistula (not *colonestomy*), *sigmoid-o-scopy* (not *sigmoidostomy*), *enterography* (not *enterostomy*) are frequently heard among gastroenterologists. The correct

term *col-ectomy* (not *colon-ectomy*) also deserves special mention. In the case of *colectomy*, it must be noted that a phonetic “ο” may *not* be added to the root *col-*. This is because the second word *εκτομή* (*ectomy*; meaning *surgical excision*) begins with the Greek vowel “ε” or “epsilon” (“e” or “E” in English) instead of a consonant. *Colectomy* is therefore phonetically fluent, as is *col-itis* rather than *colon-itis* to refer to inflammation of the *col-on*.

In summary, we believe the correct terms for “colonoscopy” and “colonography” are *coloscopy* and *colography*. We recognize that old habits die hard, and *colonoscopy* has already become the established and popular term to describe the endoscopic examination of the gut. However, with the blossoming of new diagnostic technology and imaging, this is perhaps the right point in time for the medical community to rethink these terms. In recently published guidelines on colon cancer screening, the radiological examination of the colon is being discussed as a potential screening modality¹³. It would certainly be appropriate for the term *colography* to prevail over *colonography* when referring to the multimodal, non-invasive radiologic evaluation of the gut, e.g. in the form of CT colography, PET colography, virtual coloscopy, etc. This distinction is based on principles of grammar, linguistics and semantics, which guide language and medical terminology in the same way well-defined principles should guide medical practice. Without such principles, there can only be *chaos* (*χάος*), and we feel chaos should be kept away – whenever possible – from medicine.

References

- 1) LIEBERMAN D. A call to action-measuring the quality of colonoscopy. *New Engl J Med* 2006; 355: 2588-2589.
- 2) MYSLIWIEC PA, BROWN ML, KLABUNDE CN, RANSOHOFF DF. Are physicians doing too much colonoscopy? A national survey of colorectal surveillance after polypectomy. *Ann Intern Med* 2004; 141: 264-271.
- 3) WINAWER SJ, ZAUBER AG, FLETCHER RH, STILLMAN JS, O'BRIEN MJ, LEVIN B, SMITH RA, LIEBERMAN DA, BURT RW, LEVIN TR, BOND JH, BROOKS D, BYERS T, HYMAN N, KIRK L, THORSON A, SIMMANG C, JOHNSON D, REX DK; US MULTI-SOCIETY TASK FORCE ON COLORECTAL CANCER; AMERICAN CANCER SOCIETY. Guidelines for colonoscopy surveillance after polypectomy: a

- consensus update by the US Multi-Society Task Force on Colorectal Cancer and the American Cancer Society. *Gastroenterology* 2006; 130: 1872-1885.
- 4) SZILVÁS A, SZÉKELY G, TARIÁN Z, FORNET B. Three-dimensional ultrasonography, virtual colonoscopy and endorectal magnetic resonance imaging in the diagnosis of complicated inflammatory bowel disease. *Endoscopy* 2002; 34: 94.
 - 5) KUHL C, DUMONT G. Coloscopy simulation: towards endoscopes improvement. *Comput Methods Biomech Biomed Engin* 2005; 8: 251-257.
 - 6) PINEAU BC. Motion-computerized tomographic colography is a better method for screening for polyps: arguments for the motion. *Can J Gastroenterol* 2003; 17: 125-128.
 - 7) REX DK. CT and MR colography (virtual colonoscopy): status report. *J Clin Gastroenterol* 1998; 27: 199-203.
 - 8) MULHALL BP, VEERAPPAN GR, JACKSON JL. Meta-analysis: computed tomographic colonography. *Ann Intern Med* 2005; 142: 635-650.
 - 9) VEIT-HAIBACH P, KUEHLE CA, BEYER T, STERGAR H, KUEHL H, SCHMIDT J, BÖRSCH G, DAHMEN G, BARKHAUSEN J, BOCKISCH A, ANTOCH G. Diagnostic accuracy of col-
orectal cancer staging with whole-body PET/CT colonography. *JAMA* 2006; 296: 2590-2600.
 - 10) KIM DH, PICKHARDT PJ, TAYLOR AJ, LEUNG WK, WINTER TC, HINSHAW JL, GOPAL DV, REICHELDERFER M, HSU RH, PFAU PR. CT colonography versus colonoscopy for the detection of advanced neoplasia. *N Engl J Med* 2007; 357: 1403-1412.
 - 11) SMYTH HW. *Greek Grammar*. (Revised by G.M. Messing). Cambridge, MA. Harvard University Press, 1973.
 - 12) GOODWIN WW. *A Greek Grammar*. London, UK. MacMillan, 1987.
 - 13) LEVIN B, LIEBERMAN DA, MCFARLAND B, ANDREWS KS, BROOKS D, BOND J, DASH C, GIARDIELLO FM, GLICK S, JOHNSON D, JOHNSON CD, LEVIN TR, PICKHARDT PJ, REX DK, SMITH RA, THORSON A, WINAWER SJ; AMERICAN CANCER SOCIETY COLORECTAL CANCER ADVISORY GROUP; US MULTI-SOCIETY TASK FORCE; AMERICAN COLLEGE OF RADIOLOGY COLON CANCER COMMITTEE. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *Gastroenterology* 2008; 134: 1570-1595.