The surface landmarks of the abdominal wall: a plea for standardization

Roberto Cirocchi[1], Carlo Boselli[2], Claudio Renzi[2], Alessia Corsi[2], Lucio Cagini[3], Andrea Boccolini[1], Giuseppe Noya[2], Abe Fingerhut[4]

[1]Department of Digestive Surgery, St Maria Hospital, Terni, Italy
[2]Department of General and Oncologic Surgery, University of Perugia, Faculty of Medicine, Perugia, Italy
[3]Department of Thoracic Surgery, University of Perugia, Perugia, Italy
[4]1st Department of Surgery, Hippocrateon Hospital, University of Athens Medical School, Athens, Greece

Submitted: 2 April 2013
Accepted: 19 June 2013

Arch Med Sci 2014; 10, 3: 566–569
DOI: 10.5114/aoms.2014.43749

Corresponding author:
Dr Alessia Corsi
Department
of General Surgery
University of Perugia
Faculty of Medicine
St. Maria Hospital
Via Tristano di Joannuccio n. 4
Terni, 05100, Italy
Phone: 390744205442
E-mail: corsi.alessia@tiscali.it

Abstract

Despite centuries of anatomical studies, controversies and contradictions still exist in the literature regarding the definition, anatomical terminology and the limits of the abdominal wall. We conducted a systematic research of books published from 1901 until December 2012 in Google Books. After the index screening, 16 remaining books were further assessed for eligibility. We decided to exclude journals. The aim of the study was to focus on surface landmarks and borders of the abdominal cavity. After this revision of the literature, we propose that the surface landmarks of the abdominal wall should be standardized.

Key words: surgical anatomy, abdominal wall, narrative review.

Introduction

In the literature there are many controversies and inconsistencies concerning the definition of regions of the abdomen and the landmarks of the abdominal wall. Throughout the history of surgical anatomy, including the recent literature, semiotics of the abdominal wall have been disputed. The topographical division of the abdomen and the abdominal wall is necessary to describe systematic examination and exploration of the abdomen: *Il faut "s'orienter", ici encore, pour explorer mèthodiquement cette énorme cavité* [1]. The goal of our review is to provide the surgeon with a description of standardized surface landmarks and borders of the abdominal cavity.

Material and methods

We conducted a systematic research of books published from 1901 until December 2012 in Google Books in English, Italian and French. Our search strategy included the use of the words "surgical semiotics" or "semeiotica chirurgica" or "surgical diagnosis" or "diagnostic chirurgical" or "surgical clinical examination".

According to the inclusion criteria we considered only education and teaching books in which the surface landmarks of the abdominal wall were clearly reported. Journal articles and specialist surgical books were excluded.

Results

The initial search produced 6 124 potentially relevant books. After screening titles for relevance, 16 remaining books were further assessed for eligibility.

Discussion

The abdominal cavity is bordered by the thorax cephalad, and by the pelvis caudad. The upper limit between the thoracic cavity and the abdominal cavity is represented by a horizontal plane passing through the base of the xiphoid appendix (xiphisternal articulation) and the spinous process of the 12th dorsal vertebra (Figure 1 A).

The topographic subdivision of the abdominal wall into upper, lower, anterior, posterior and lateral occurred long before Lejars in 1923 and Stern in 1928 [1, 2]. The right upper quadrant (RUQ) and left upper quadrant (LUQ) extend from the median plane to the right or the left of the patient, and from the umbilical plane to the right or left ribcage, respectively. The right lower quadrant (RLQ) and left lower quadrant (LLQ) extend from the median plane to the right or left of the patient, and from the umbilical plane to the right or left inguinal ligament, respectively. In French, there are 9 regions (epigastrium, hypogastrium, umbilical region, right and left flanks, left and right hypochondrium, left and right iliac) (Figure 2).

However, surgeons, still disagree on this division.

For Lejars (1923), Rasario (1957), Ruggeri (1968), Fradà (2009) and Swartz (2010) [1, 3–6], the upper limit of the anterior abdominal wall does not correspond to the upper limit of the abdomen, as already highlighted by Dominici (1932) [7] and Provenzale (1963) [8], but is delimitated by a thoraco-abdominal line that begins at the level of the ensiform apophyses and then heads at the lowest edge of the costal arch. On the other hand, for De Franciscis *et al.* (1998) [9] and Bellantone *et al.* (2009) [10] the upper wall of the abdominal cavity is represented by a thoraco-abdominal line that extends back to the spinous process of the 12th thoracic vertebra.

Standring (2008), Moore *et al.* (2010), Berti Riboli and Gipponi (2010), and Thomas and Monaghan

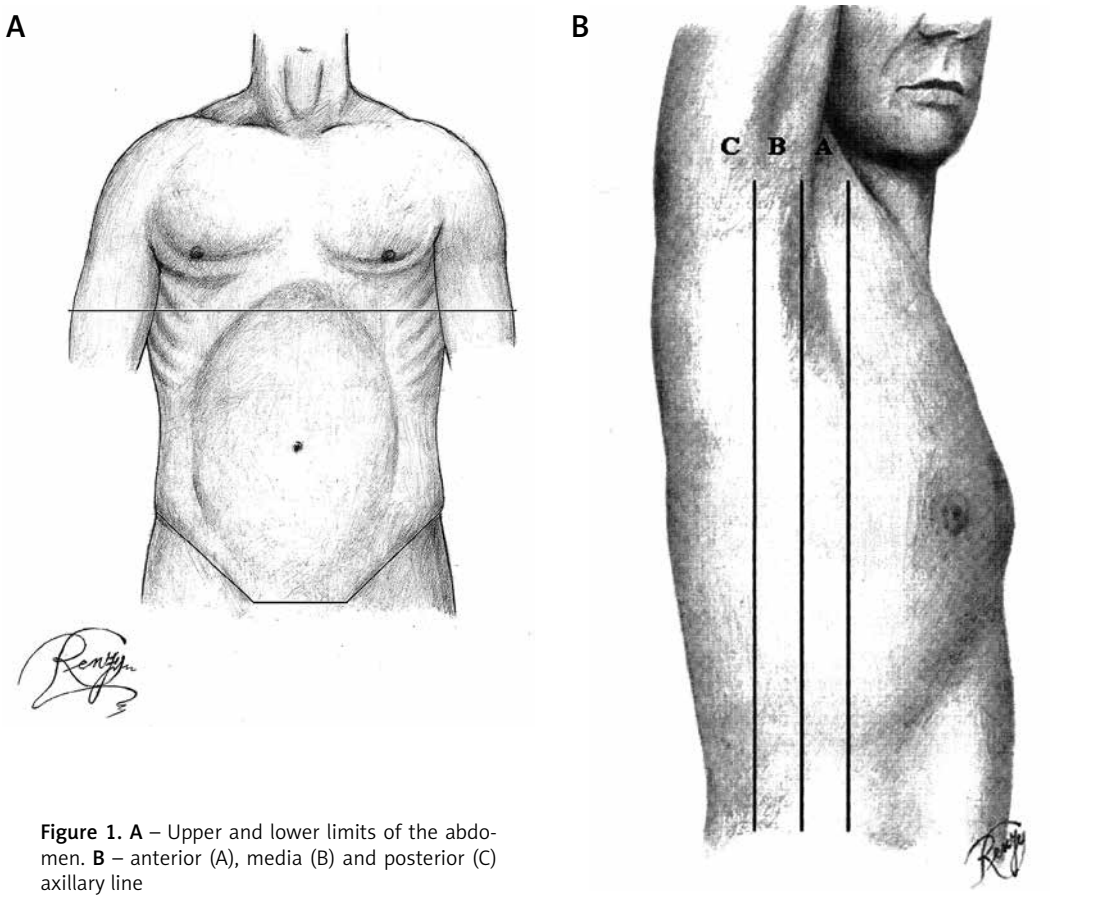

Figure 1. A – Upper and lower limits of the abdomen. **B** – anterior (A), media (B) and posterior (C) axillary line

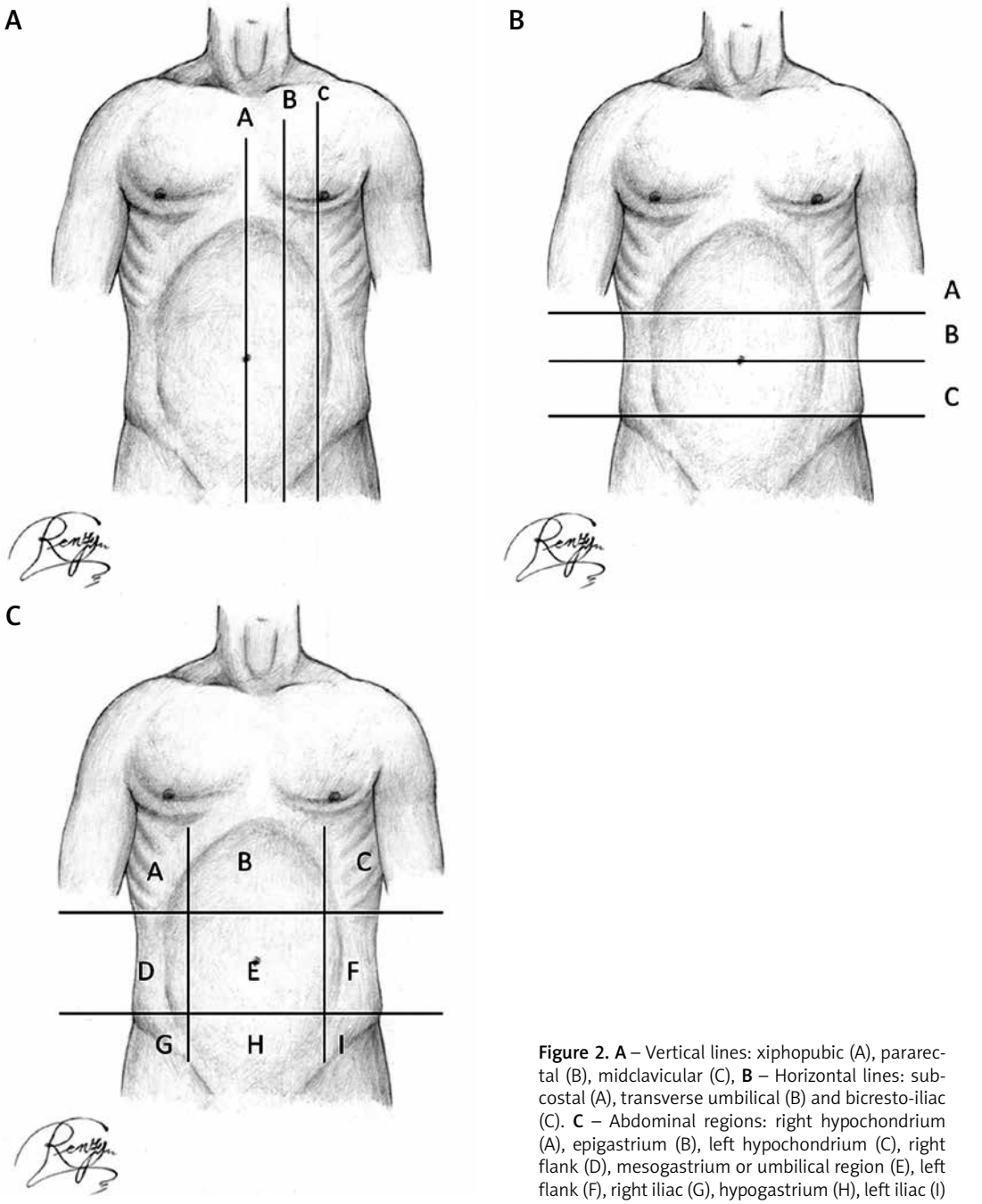

Figure 2. A – Vertical lines: xiphopubic (A), pararectal (B), midclavicular (C), **B** – Horizontal lines: subcostal (A), transverse umbilical (B) and bicresto-iliac (C). **C** – Abdominal regions: right hypochondrium (A), epigastrium (B), left hypochondrium (C), right flank (D), mesogastrium or umbilical region (E), left flank (F), right iliac (G), hypogastrium (H), left iliac (I)

(2007) [11–14] distinguish the upper limit of the anterior abdominal wall (the thoraco-abdominal line) from the line for the abdominal cavity (the diaphragm).

Moore *et al.* (2010) [12] used the term "costal line" as an alternative to the "thoraco-abdominal line".

According to Dominici (1932) [7] and Provenzale (1963) [8] "i limiti del torace che si debbano considerare in clinica sono diversi da quelli anatomici, perché se nello studio del malato si considerasse come limite inferiore del torace il margine convesso delle costole si dovrebbero comprendere nell'esame clinico della cavità toracica il fegato, la milza" *(The clinically relevant limits of the chest are different from the anatomical limits, because if the convex edge of the ribs is considered as the lower limit of the chest in the study of the patient, it should include in the clinical examination of the thoracic cavity the liver and the spleen).*

Conversely, there are few controversies as to the lower limit, which starts from the pubic symphysis, runs along the entire inguinal arc and iliac crest, and terminates at the spinous process of the 5th lumbar vertebra (Figure 1 B).

In the physical examination of the abdomen, the fundamental landmarks are the axillary lines, as follows:

- *anterior axillary line* (right and left), which runs vertically from the anterior corner formed by the pectoralis major muscle to the chest wall (Figure 2 A);
- *midaxillary* line (right and left), which descends from the apex of the axillary cavity (Figure 2 B);
- *posterior axillary line* (right and left), which descends from the posterior corner formed by the latissimus dorsi muscle and the chest wall (Figure 2 C).

These axillary lines thus divide the abdomen into four walls: anterior, posterior, right and left lateral.

Anterior wall: the area between the two anterior axillary lines: right and left.

Posterior wall: between the two posterior axillary lines.

Lateral walls (right and left): between the anterior and posterior axillary lines.

In some anatomical books (Gray 2008; Moore *et al.* 2010) and in some surgery books (Bellantone *et al.* 2010; Dionigi 2011), the abdominal wall is divided only into two: anterior-lateral and posterior [12, 15].

For Bellantone [10] "la parete antero-laterale passa in quella postero-laterale senza soluzione di continuità lungo il corpo dei tre muscoli larghi dell'addome (obliquo esterno, obliquo interno e trasverso)" (the antero-lateral wall passes in that postero-lateral seamless along the body of the three broad muscles of the abdomen: external oblique muscle, internal oblique muscle and transverse abdominal muscle). For Dionigi [15], the limit is "una linea verticale che decorre dalla spina iliaca antero-superiore al margine costale" (a vertical line that runs from the anterior superior iliac spine to the costal margin). In the classic work written by John Skandalakis [16] (The Embryologic and Anatomic Basis of Modern Surgery): "The anterior abdominal wall can be considered to have two parts: anterolateral and middle (or midline). The anterolateral portion is composed of the external oblique, the internal oblique, and the transversus abdominis muscles. The middle portion is composed of the rectus abdominis and pyramidal muscles."

On the other hand, according to Dominici (1932) [7] and Provenzale (1963) [8], the posterior wall of the abdomen is limited by the paralumbar lines (Dominici 1932 [7]; Ruggieri 1968 [4]) and by the lateral margin of the sacro-lumbar muscles (Provenzale 1963 [8]), which always correspond to the posterior axillary lines (De Franciscis *et al.* 1998 [9]).

In conclusion, our review demonstrates that controversy concerning some anatomical aspects of the abdomen and abdominal wall still exists. The surface landmarks of the abdominal wall should be standardized. We propose, according to Dominici and Provenzale, that the limit of the abdominal wall and that of the abdominal cavity are to be considered different. Thus the upper limit of the abdominal cavity consists in a horizontal plane passing through the xiphisternal articulation and the spinous process of the 12th dorsal vertebra (Figure 1 A). Consequently the upper limit of the abdominal wall is represented by the thoraco-abdominal line which starts from the xiphoid appendix, runs along the lower edge of the costal arch and reaches the 12th thoracic vertebra.

As regards the subdivision of the abdominal wall in the transverse plane we suggest the axillary lines as landmarks instead of muscle borders which widely vary between the authors. Furthermore, we propose to separate the lateral wall from the anterior one, by considering the anterior axillary line as a border between them.

References

1. Lejars F. Exploration clinique et diagnostic chirurgical. Masson Editeurs, Paris 1923.
2. Stern WM. Diagnostic chirurgical. Masson Editeurs, Paris 1928.
3. Rasario GN. Manuale di semeiotica medica. Idelson-Gnocchi, Napoli 1957.
4. Ruggeri E. Trattato di semeiotica e diagnostica chirurgica. UTET, Torino 1968
5. Fradà G. Semeiotica medica nell'adulto e nell'anziano. 4th edition. Piccin, Padova 2009; 1046.
6. Swartz MH. Textbook of physical diagnosis: history and examination. 4th edition. Saunders, Philadelphia 2001; 848.
7. Dominici L. Compendio di semeiotica chirurgica. 2nd edition. Casa Editrice Luigi Pozzi, Roma 1932; 466.
8. Provenzale L. Manuale di semeiotica chirurgica. 4th edition. Casa Editrice Luigi Pozzi, Roma 1983; 1160.
9. De Franciscis S, Gentile A, Procaccini E. Semeiotica e metodologia chirurgica. Idelson-Gnocchi, Napoli 1998; 440.
10. Bellantone R, De Toma G, Montorsi M. Chirurgia generale. Edizioni Minerva Medica, Torino 2009; 1216.
11. Standring S. Gray's anatomy. 40th edition. Elsevier, London 2008.
12. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 6th edition. Lippincott William & Wilkins, Baltimora 2010.
13. Berti Riboli E, Gipponi M. Semeiotica e metodologia chirurgica. 3rd Edition. ECIG, Genova 2010; 416.
14. Thomas J, Monaghan T. Oxford handbook of clinical examination and practical skills. Oxford University Press, Oxford 2007.
15. Dionigi R. Chirurgia. 5th edition. Elsevier, Milano 2011; 1884.
16. Skandalakis J. The embryologic and anatomic basis of modern surgery. McGraw-Hill Professional Publishing, New York 2004.