

The Brisbane 2000 Terminology of Liver Anatomy and Resections

**Terminology Committee of the International Hepato-Pancreato-Biliary Association:
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Background

The Scientific Committee of the IHPBA, meeting in December 1998, created a Terminology Committee to deal with the confusion in nomenclature of hepatic anatomy and liver resections. A terminology was sought which was anatomically correct, in which anatomical and surgical terms agreed, and which was consistent, self-explanatory, linguistically correct, translatable, precise and concise.

Discussion

After 18 months the International Committee presented a terminology that was accepted by the IHPBA at the recent World Congress in Brisbane. The purpose of this paper is to present that terminology.

Keywords

liver anatomy, hepatectomy, liver surgery.

Introduction

History

In December 1998, at its meeting in Berne, Switzerland, the Scientific Committee of the IHPBA established a Terminology Committee to deal with the confusion in terminology of hepatic anatomy and liver resections. This Committee consisted of eight HPB surgeons from around the world. One of the first tasks of the Committee was to seek input from the membership of the IHPBA, and to this end a survey questionnaire setting out 46 propositions was published in *HPB* several months ago[1]. After working for nearly 18 months, the Terminology Committee presented its recommendations to the Scientific Committee at the World Congress of the IHPBA in Brisbane, Australia in May, 2000. These recommendations, consisting of a new terminology termed *The Brisbane 2000 Terminology of Liver Anatomy and Resections*, were unanimously accepted by the Scientific Committee of the IHPBA and were presented to the membership as the official terminology of the IHPBA on the final day of the meeting. A description of the new terminology follows.

'Anatomy' and 'Terminology of Anatomy'

The task of the Committee was to deal with terminology of hepatic anatomy and resections and not with anatomy *per se*. It had no responsibility to investigate hepatic anatomy or to settle any anatomical disputes. The terminology has been based on the accepted anatomy; this point was especially important when naming the second-order division of the liver. For a complete discussion see under Attributes of the terminology: Consistent.

Use and citation of the terminology

Members of the IHPBA are encouraged to use and disseminate this terminology. When citing this terminology in publications, the citation should read:

The Brisbane 2000 Terminology of Liver Anatomy and Resections. Terminology Committee of the International Hepato-Pancreato-Biliary Association. *HPB*. 2000;2(3): 333-39.

The future

The Terminology Committee will remain intact at least for the next two years, to monitor the use of the terminology

and to accept suggestions for change. Revisions of the terminology (if required) will be adopted at future world congresses of the IHPBA. Members are encouraged to write to the Chairman of the Terminology Committee with their comments.

Attributes of the terminology

The following eight attributes were considered desirable for the terminology: 1. anatomically correct; 2. anatomical and surgical terms agree; 3. consistent; 4. self-explanatory; 5. linguistically correct; 6. translatable; 7. precise; 8. concise.

1. Anatomically correct

This attribute requires that the most common anatomical pattern (*la disposition modiale*) be the basis for naming anatomical structures.

2. Anatomical and surgical terms agree

This attribute requires that the terminology for liver resections be based on the anatomical nomenclature. For instance, if the anatomical terminology for each side of the liver is 'hemiliver', then the correct name for resection of one side of the liver would be 'hemihepatectomy' rather than some other term.

3. Consistent

This attribute requires that the terminology be based on one single method rather than multiple methods of dividing the liver. Surface markings and internal vascular (including biliary) anatomy are two different ways by which the liver might be divided. These different methods should not be mixed in describing the several levels of division of the liver (e.g. one level by internal anatomy and another by surface markings); the terminology of the anatomical divisions should be based completely on internal anatomy.

The watersheds of the hepatic artery, bile duct and portal vein are identical except for the second-order division of these structures on the left side of the liver. The arterial and biliary watersheds divide the left side of the liver through the umbilical fissure. All anatomists, including Couinaud [2] and Healey [3,4], agree on this point. The portal vein watershed divides the left side of the liver through the plane between segments 2 and 3 (Couinaud). Since both modes of division of the left side of the liver are currently accepted as anatomically correct, two terminologies are required for the second-order division of the liver. It should

be noted that, on the right side of the liver, the second-order watersheds of the hepatic artery, bile duct and portal vein are identical. Therefore, on the left side of the liver the two terminologies describe anatomically distinct structures, whereas on the right side they describe the same anatomical structures.

To deal with this matter without making the terminology unacceptably complex, especially for those other than HPB surgeons, the terminology for the second-order division on the left, based on the portal vein, is presented as an addendum. There is no implication that this alternative terminology is less correct. The division based on the portal vein was the one selected for the addendum because surgical resections passing close to the plane between segments 2 and 3 are much less common than resections passing through a plane close to the umbilical fissure.

Although the terminology was unanimously accepted by the members of the Committee, there was divergent opinion regarding the position of the terminology for the second-order division on the left based on the portal vein. One view was that it should be included in the body of the description; a second view was that it should be eliminated altogether, as making the terminology too complex. However, a very clear majority of the Committee opted for the addendum.

4. Self-explanatory

This attribute requires that the terminology be internally evident. Eponymous terms such as 'Cantlie's line' are not internally evident because they contain no intrinsic information; it is necessary to provide an explanation of 'Cantlie's line'. A contrasting term would be 'midplane of the liver' or 'hemiliver', these terms contain internalised information which make their meaning clearer.

5. Linguistically correct

This attribute requires that the terminology be linguistically correct and applicable to the organ itself. Linguistic correctness asks that the term be true to its root meaning and also to its use in common language. Some anatomical terms that have been used in hepatic anatomy do not fulfil this aim: for instance, anatomical drawings are usually two-dimensional; therefore, it is not unusual to have borders defined as 'lines'. However, organs are three-dimensional and so, when borders are present, they are usually 'planes'. 'Lobe' is linguistically incorrect when applied to a division of an organ when there is no surface marking such as a

fissure to indicate that division; therefore 'lobe' is undesirable when referring to the two sides of the organ based upon vascular anatomy, since there is no surface marking for this plane. 'Fissure or scissure' is similarly undesirable when there is no cleft on the organ at that position, even though there is a watershed present and a cleft is present in digested casts of the organ. These considerations are also closely related to the goals of attribute 4.

6. *Translatable*

This attribute requires that the terminology should be translatable. In this regard, note that the third-order division into segments is referred to in Arabic rather than Roman numerals, i.e. segments 1–9 rather than segments I–IX.

7. *Precise*

This attribute requires that a term has only one meaning. Currently, there are two terms in use which each have two meanings: 'lobe' and 'segment'. Lobe in one usage refers to a hemiliver and is linguistically incorrect for reasons given above; in another usage it refers to surface anatomy rather than internal anatomy. As a term of surface anatomy it is not excluded, but it is excluded as a basis for naming liver resections (see under attribute 3: Consistent). 'Segment' is now restricted to the third-order division as in Couinaud segments 1–9. It is not used for naming the second-order division based on the hepatic artery and bile duct watersheds as proposed by Healey. For this purpose a new term is introduced, namely 'section'. The term for second-order division based on the portal vein watershed – 'sector' as per Couinaud – is retained. It should be noted that the three terms 'segment', 'section', and 'sector' are all derived from the same Latin root meaning 'to cut' and do not imply the presence of a fissure. It is linguistically correct to apply them to a division based on internal anatomy, such as a vascular watershed, even when there are no surface markings on the organ indicative of that watershed. Note also that it is now possible to refer to 'segments' without stipulating 'Couinaud segments', as the term has only one meaning.

This attribute also comes into play in the use of the word 'extended'. Although the word is retained as part of a description of certain liver resections, it is not a preferred term since 'extended' does not stipulate whether the extension is to all or part of an adjacent segment, section or sector.

In the case of the second division of the liver based on the portal vein, 'paramedian' sector and 'medial' sector are synonymous, as are 'lateral' sector and 'posterior' sector.

8. *Concise*

This attribute requires that terms be brief and to the point.

The Brisbane 2000 Terminology of Hepatic Anatomy and Liver Resections

The terminology is presented as a set of three main (illustrated) tables and an addendum. The liver is divided in the tables into successive orders. The following notes serve as a guide to the tables.

Note 1.

The pertinent areas in the diagrams accompanying the tables are highlighted in heavy black outline.

Note 2.

Couinaud segments are indicated in short form as Sg1–9 (e.g. Sg6). Sg is chosen rather than S, to avoid confusion of segment with section or sector. Arabic numerals are chosen rather than Roman numerals because many non-western nations do not use Roman numerals.

Note 3.

Wherever the word 'OR' (uppercase, bold) appears in the table it indicates equally acceptable terminology: e.g. 'right hemiliver' OR 'right liver'. The choice is that of the user. Wherever the word 'or' (lowercase, bold) appears in the table or these notes it indicates that the first choice is preferred but that the second is acceptable: e.g. 'right trisectionectomy' or 'extended right hepatectomy'. The choice is up to the user, but the first term is the preferred term. The reason in this case is as follows: as some use the adjective 'extended' to indicate any degree of extension of a resection over the midplane (which in some cases, is less than a whole section), the terms in the table containing the word 'extended', while acceptable, are less preferred.

Note 4.

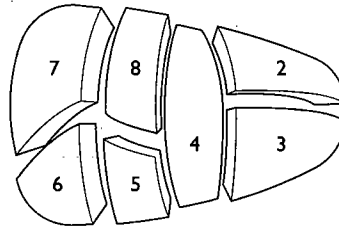
An alternative and equally correct terminology for the 'second-order division' is contained in the addendum to the table. In the body of the table, the second-order division is based on Healey's and Couinaud's concept of division of the artery and bile duct; in the addendum the second order is based on Couinaud's concept of portal vein divisions. The second-order division in the addendum is included because it preserves the ability to name certain uncommon resections on the left side according to Couinaud's concepts of the portal and hepatic veins, e.g. left paramedian sectorectomy.

Note 5.

When segment 1 is resected as part of a procedure, it should be stated as in the following example: 'left hemihepatectomy with resection of segment 1' or 'left hemihepatectomy extended to segment 1'.

Table 1. First-order division

Schematic diagram of the segments for reference in the table (for purposes of clarity Sg1 is not shown)



Anatomical term	Couinaud segments referred to	Term for surgical resection	Diagram (pertinent area is in heavy black outline)
Right hemiliver OR Right liver	Sg5-8(+/-Sg1)	Right hepatectomy OR Right hemihepatectomy (stipulate +/- segment 1)	
Left hemiliver OR Left liver	Sg2-4 (+/-Sg1)	Left hepatectomy OR Left hemihepatectomy (stipulate +/- segment 1)	

Border or watershed:

The border or watershed of the first-order division which separates the two hemilivers is a plane that intersects the gallbladder fossa and the fossa for the IVC and is referred to as the *midplane of the liver*.

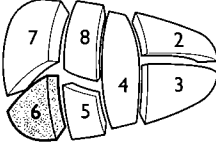
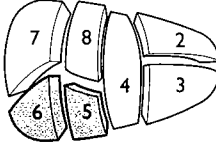
Table 2. Second-order division

Anatomical term	Couinaud segments referred to	Term for surgical resection	Diagram
Right anterior section	Sg5,8	Add '-ectomy' to any of the anatomical terms as in <i>Right anterior sectionectomy</i>	
Right posterior section	Sg6,7	<i>Right posterior sectionectomy</i>	
Left medial section	Sg4	<i>Left medial sectionectomy</i> OR Resection segment 4 (also see under third order) OR Segmentectomy 4 (also see under third order)	
Left lateral section	Sg2,3	<i>Left lateral sectionectomy</i> OR Bisegmentectomy 2,3 (also see under third order)	
Right hemiliver plus left medial section	Sg4-8 (+/-Sg1)	<i>Right trisectionectomy</i> or <i>Extended right hepatectomy</i> or <i>Extended right hemihepatectomy</i>	
Left hemiliver plus right anterior section	Sg2,2-5,5,8 (+/-Sg1)	<i>Left trisectionectomy</i> or <i>Extended left hepatectomy</i> or <i>Extended left hemihepatectomy</i>	

Borders or watersheds:

The borders or watersheds of the sections are planes referred to as the *right and left intersectional planes*. The left intersectional plane passes through the umbilical fissure and the attachment of the falciform ligament. There is no surface marking of the right intersectional plane.

Table 3. Third-order division

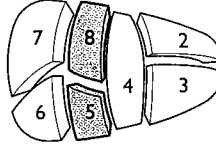
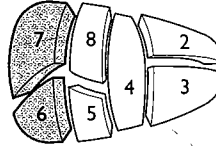
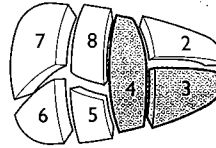
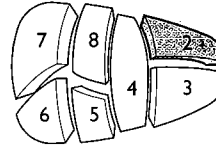
Anatomical term	Couinaud segments referred to	Term for surgical resection	Diagram
Segments 1-9 (Segmentectomy 6)	Any one of Sg1 to Sg9	Segmentectomy	
2 contiguous segments	Any two of Sg1 to Sg9 in continuity	Bisegmentectomy	 (Bisegmentectomy 5,6)

Borders or watersheds:

The borders or watersheds of the segments are planes referred to as *intersegmental planes*.

It is also acceptable to refer to ANY resection by its third-order segments, e.g. *right hemihepatectomy* can also be called *resection Sg5-8*.

Addendum. Alternative second-order division (second-order division based on portal vein)

Anatomical term	Couinaud segments referred to	Term for surgical resection	Diagram
Right anterior sector OR Right paramedian sector	Sg5,8	Add '-ectomy' to any of the anatomical terms, as in <i>Right anterior sectorectomy</i> OR <i>Right paramedian sectorectomy</i>	
Right posterior sector OR Right lateral sector	Sg6,7	<i>Right posterior sectorectomy</i> OR <i>Right lateral sectorectomy</i>	
Left medial sector OR Left paramedian sector	Sg3,4	<i>Left medial sectorectomy</i> OR <i>Left paramedian sectorectomy</i> OR <i>Bisegmentectomy 3,4</i>	
Left lateral sector OR Left posterior sector	Sg2	<i>Left lateral sectorectomy</i> OR <i>Left posterior sectorectomy</i> OR <i>Segmentectomy 2</i>	

Right anterior sector and right anterior section are synonyms. Right posterior sector and right posterior section are synonyms.

Left medial sector and left medial section are NOT synonyms and are NOT exchangeable terms. They do not describe the same anatomic areas.

Left lateral sector and left lateral section are NOT synonyms and are NOT exchangeable terms.

Borders or watersheds:

The border or watersheds of second-order division based on the portal vein are referred to as *right and left intersectoral planes*. These have no surface markings.

References

- 1 Strasberg SM for the IHPBA Terminology Committee Survey. Terminology of hepatic anatomy and resections. *HPB* 1999; **1**:191-201.
- 2 Couinaud C. *Le foie. Etudes Anatomiques et chirurgicales*. Paris: Masson & Cie, 1957.
- 3 Healey JE Jr, Schroy PC. Anatomy of the biliary ducts within the human liver: analysis of the prevailing pattern of branchings and the major variations of the biliary ducts. *Arch Surg* 1953;**66**:599-616.
- 4 Healey JE. Clinical anatomic aspects of radical hepatic surgery. *J Int Coll Surg* 1954;**22**:542-50.