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IMPORTANT BILIARY DRAINAGE VARIATIONS OF LEFT LIVER LOBE

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A b s t r a c t: Biliary drainage of the left liver lobe has been examined in view of the current surgical trends for using the left liver lobe of living parent donor for liver transplantation. For this purpose, on 13 acrylic casts of porto-biliary elements of the liver, variations of pattern and level of merging of segmental ducts into a left lobe (lateral) duct were determined in comparison with the main portal trunks. Duplication of ducts was noticed in segments 2 and 3; merging of a duct from the left portion of segment 1 with a duct from segment 2; merging of a double left medial duct with a duct from segment 3 and a magistral pattern of consecutive confluence of segmental ducts from lateral and medial sectors as well as from the left portion of segment 1 into a duct arising from segment 3.

Bearing in mind lateral tributaries of the left lobe duct that comprise segment 2, the left portion of segment 1 and subsegment 9 "b" from the right dorsal sector, the disadvantages of obtaining a left lobe graft can be identified.

Key words: Liver, left lobe, anatomy, biliary duct-variations, transplantation.

Introduction

Pathological changes of intrahepatic biliary ducts, congenital malformations and anatomic variants in their consecutive outflow from structural liver units are parameters that have to be detected and differentiated from the normal finding during indicated clinical examinations. An innovative, developmental and safe technique for the identification of subtle ductal pathology, anatomic variations, selection of patients for approved surgical interventions, and evaluation of

postoperative changes and their alterations as against the standard techniques (PTC, ERCP) is MRCP – magnetic resonance cholangiopancreatography – Gjoreski 2000, Zhong *et al*. 2004, etc.

From this point of view, this study presents variations in the pattern of creation of the biliary duct of the left liver lobe. At the same time, particular attention has been paid to the level of confluence of segmental ducts into a lobe duct and their location as compared to the main portal trunks.

Our interest in the left liver lobe has been initiated by the current surgical trends in the treatment of liver damage that predict the left lobe liver transplantation from a living donor.

Based on his own experience, Reding pointed out in 2008 the advantages of this approach – left liver lobe transplantation from a living parent donor by application of immunosuppressive protocols versus left segmental allografts from adult cadaveric donors for pediatric candidates.

Couinaud also reported in 1999 that transplantation of the left liver or left lobe alone is important to avoid any risk to the donor. Right liver transplanttation seemed more dangerous, but nevertheless it was realized in Japan.

Material and methods

The material for this study included 13 post-mortem obtained samples of adult human liver of both sexes.

The applied methodology consisted of preparation of the samples with intrahepatic washing out of portovenous and biliary elements and dissection of their extrahepatic units. This was followed by the injection of a stained acrylic mixture for rapid polymerization in the bile ducts, but also in the portal vein, where the intrahepatic arborization is accompanied by biliary ducts. The injected organ underwent corrosion in concentrated HCL acid.

Thus, acrylic casts of the intrahepatic spatial distribution of the portobiliary elements were obtained.

The observation of acrylic casts under light magnifying glass enabled:

– Examination of biliary drainage of the left liver lobe according to the functional segmental division of the organ;
– Determination and differentiation of patterns of creation of the duct from the left lobe of segmental ducts;
– Determination of the level of confluence of segmental ducts into a left lobe (lateral) duct and location of the confluence in comparison with the main portal trunks.

Cases with observed anatomic variations are presented in diagrams and figures.

Results

In 6 (46.1%) of the examined samples, deviations from the normal pattern of biliary drainage of the left liver lobe through the constituent ducts were found: a duct from segment 3 (Sg 3) and a duct from segment 2 (Sg 2).

The pattern of creation of the left lobe duct (LLD) from segmental ducts is presented for each case of the observed anatomic variations (4 of the 6 cases). Lateral tributaries that entirely determine the drainage area of the lobe duct were also determined for the segmental ducts and for LLD.

Anatomic variation was also seen in the two cases where the lobe duct arising from a duct of segment 3 by magistral pattern subsequently accepted from a lateral or a medial aspect tributaries from segments of both the lateral and medial sector of the left functional hemi-liver and in one of them from the left portion of segment 1 (*lobus caudatis*) as well.

The following locations have been noticed for the level of confluence of segmental ducts into a left lobe duct versus portal elements:

a) **along the left margin of the umbilical portion of the left portal branch** – anterior and under the level of arising of the portal branch for segment 2 (Fig. 6)

b) **anterior to the umbilical portion of the left portal branch** – medially, substantially under the level of arising of the portal branch for segment 2 (Fig. 2)

c) **anterior to the terminal part of the transversal portion of the left portal branch**

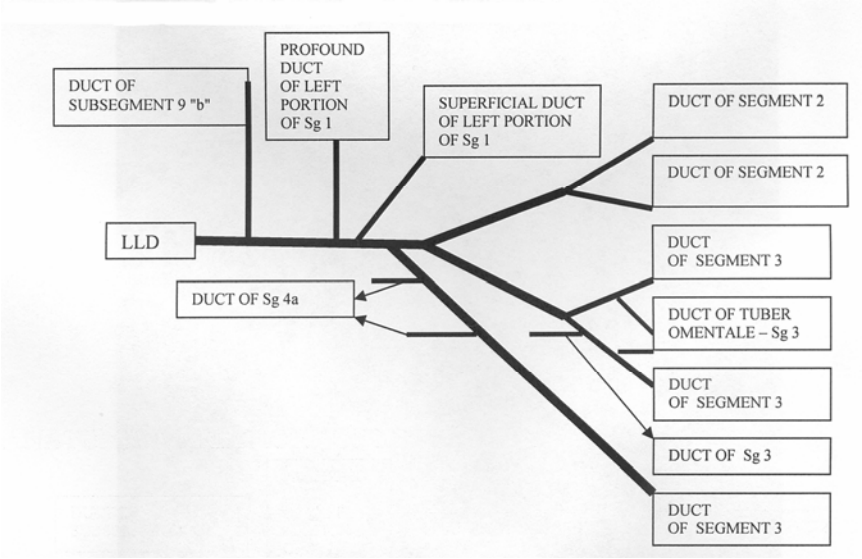
– medially (Fig. 3)

– on the level of anterior margin of the portal branch for segment 2 (Fig. 4)

d) **anterior to the medial third of the transversal portion of the left portal branch** – above the level of posterior margin (Fig. 1)

e) behind and above the level of the medial part of the posterior margin of the portal branch trunk for segment 3 (Fig. 5).

ANATOMIC VARIATIONS OF LEFT LOBE DUCT



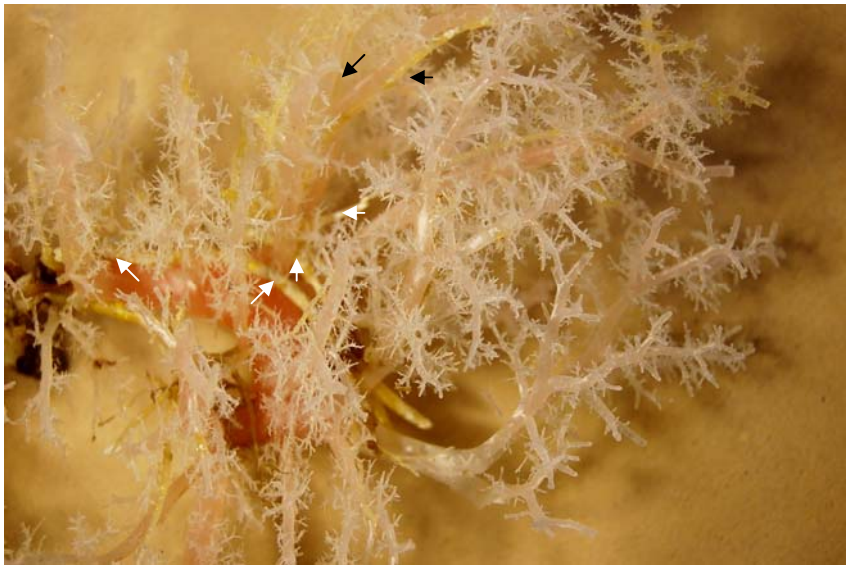
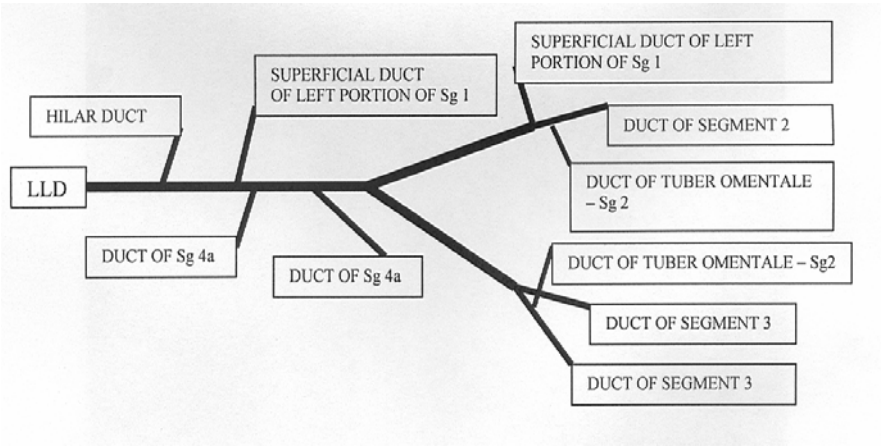


Figure 1 – Case no. 1 – Diaphragmal aspect of acrylic cast: LLD, three ducts of Sg 3 (white arrow); 2 ducts of Sg 2 (black arrow)
Слика 1 – Случај бр. 1 – Дијафраг̄матīски асīекīт на акрилна одливка: ЛЛК, īри канали на Сг̄ 3 (бела сīрелка); 2 канали на Сг̄ 2 (црна сīрелка)



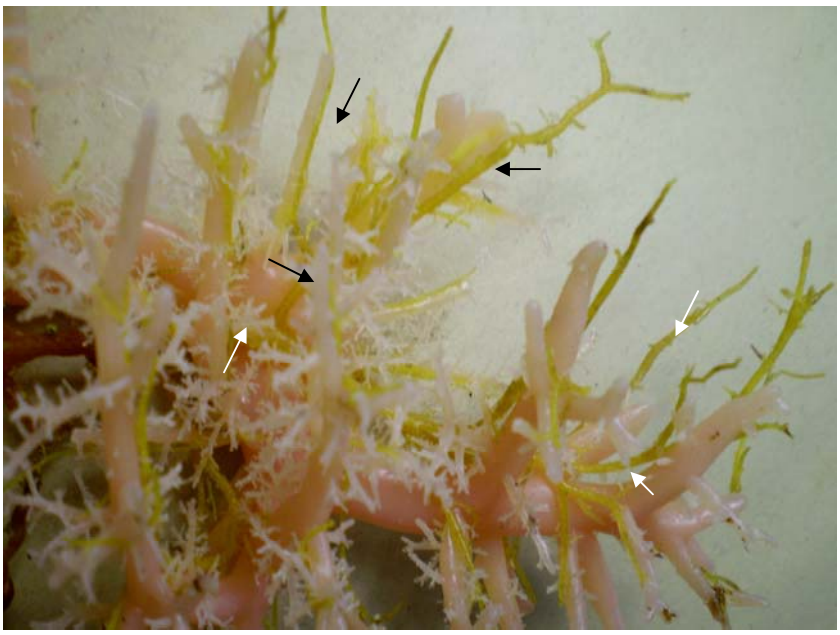


Figure 2 – Case no. 2 – Diaphragmal aspect of acrylic cast: LLD, 2 ducts of Sg 3 (white arrow); duct of Sg 2, superficial duct of left portion of Sg 1, common trunk of ducts of Sg 2 and Sg 1 (black arrow)
Слика 2 – Случај бр. 2 – Дијафрагмашки аспект на акрилна одливка: ЛЛК, 2 канали на Сг 3 (бела стрелка); канал на Сг 2, површен канал од левото порцио на Сг 1, заедничко стебло на каналите од Сг 2 и Сг 1 (црна стрелка)

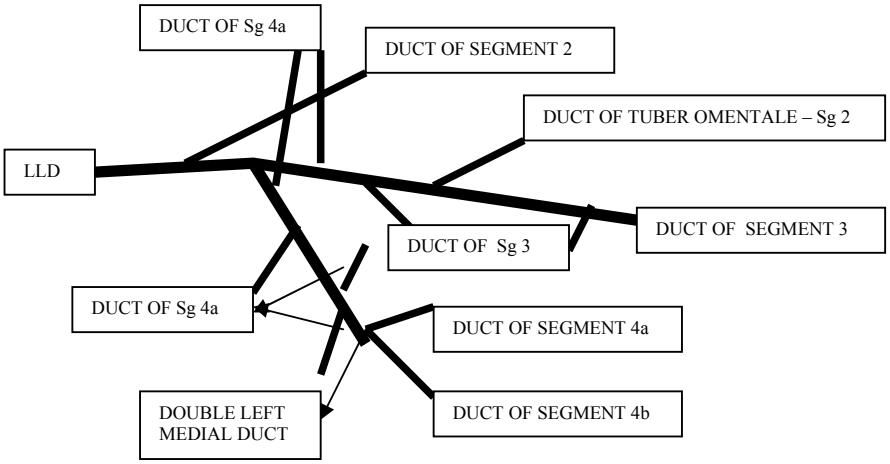


Figure 3 – Case no. 3 – Diaphragmal aspect of acrylic cast: LLD, duct of Sg 3, double left medial duct (white arrow); duct of Sg 2 (black arrow)
Слика 3 – Случај бр. 3 – Дијафрагматски аспект на акрилна одливка: ЛЛК, канал на Сг 3, удвоен лев медијален канал (бела стрелка); канал на Сг 2 (црна стрелка)

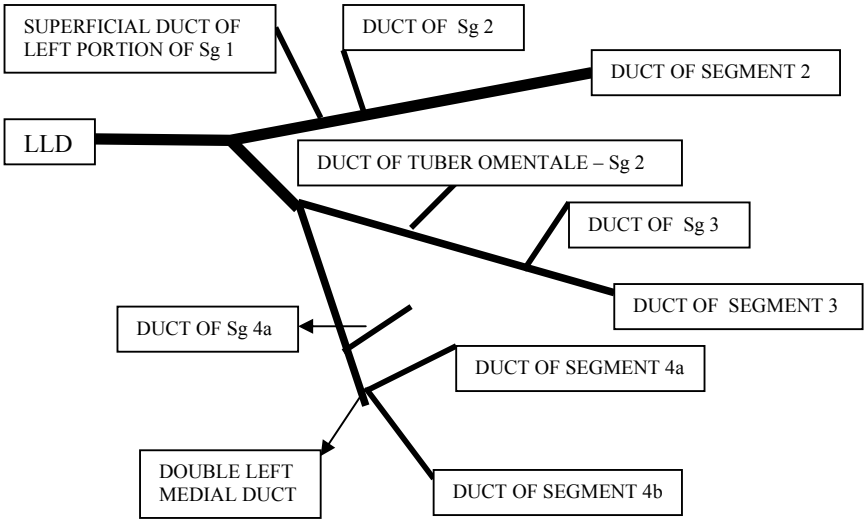


Figure 4 – Case no. 4 – Diaphragmal aspect of acrylic cast: LLD, duct of Sg 3, double left medial duct (white arrow); duct of Sg 2, superficial duct of left portion of Sg 1 (black arrow)

Слика 4 – Случај бр. 4 – Дијафрагматски аспект на акрилна одливка: ЛЛК, канал на Сг 3, удвоен лев медијален канал (бела стрелка); канал на Сг 2, површен канал од левото порцио на Сг 1 (црна стрелка)

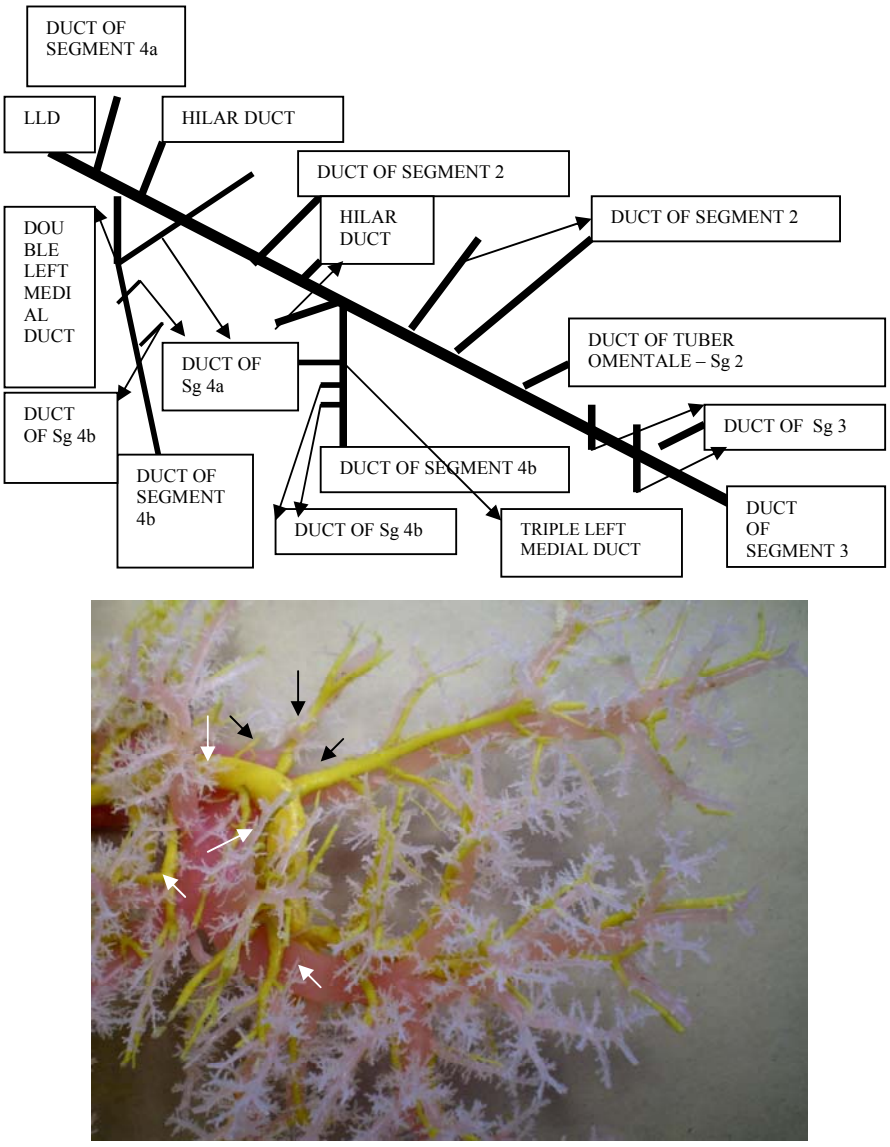


Figure 5 – Case no. 5 – Magistral pattern of drainage. Diaphragmal aspect of acrylic cast: LLD, duct of Sg 3, triple left medial duct, double left medial duct (white arrow); 3 ducts of Sg 2 (black arrow)

Слика 5 – Случај бр. 5 – Магистрален начин на дренажа. Дијафрагмаtски аспект на акрилна одливка: ЛЛК, канал на Сг 3, утроен лев медијален канал, удвоен лев медијален канал (бела стрелка); 3 канали на Сг 2 (црна стрелка)

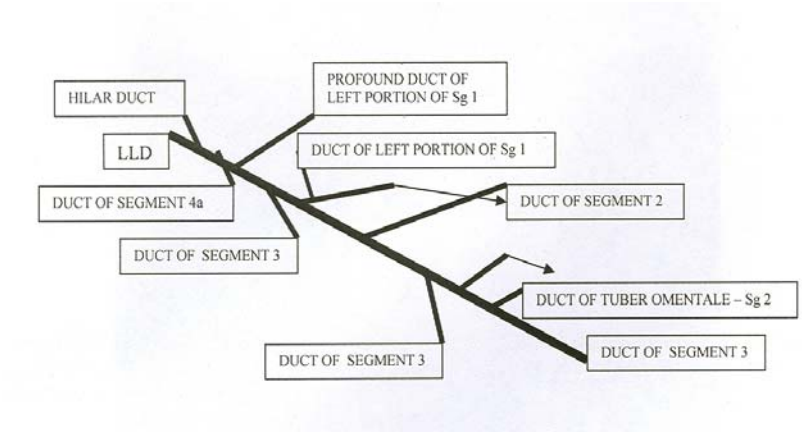


Figure 6 – Case no. 6 – Diaphragmal aspect of acrylic cast: LLD, 2 ducts of Sg 3, duct of Sg 4a (white arrow); 2 ducts of Sg 2, duct of left portion of Sg 1, profound duct of left portion of Sg1 (black arrow)
Слика 6 – Случај бр. 6 – Дијафрагматски аспект на акрилна одливка: ЛЛК, 2 канали на Сг 3, канал на Сг 4а (бела стрелка); 2 канали на Сг 2, канал од левото порцио на Сг 1, длабок канал од левото порцио на Сг 1 (црна стрелка)

Discussion

The variations presented for segmental biliary drainage of the left liver lobe are a potential risk for the onset of iatrogenic intraoperative biliary damage or postoperative complications.

The number of segmental ducts, pattern of their convergence, and especially the location of their confluence into the left lobe duct against the portal elements determines the possibilities for obtaining and performing left lobe living parent donor liver transplantation.

According to Couinaud 1999, the principal aim is to obtain a left liver or a left lobe with a unique artery and a unique bile duct. Biliary segmental distribution of type (3 + 4) + 2 is a common reason for unsuccessful transplantation.

Two of the examined samples had a common trunk of the duct of segment 3 and a double left medial duct (4a and 4b). This trunk merges with a duct of segment 2 anteriorly, from the terminal part of the transversal portion of the left portal branch in case no. 4 and its prolongation into a left lobe duct that accepts the duct from segment 2 as a lateral tributary, observed in case no. 3.

In case no. 1 partial drainage of segment 4a is noticed from the medial left sector via a duct of segment 3 that has a separate and late confluence into the left lobe duct even before the medial 1/3 of the transversal portion of the left portal vein. In the same case double ducts from segments 2 and 3 merged into common trunks.

Extremely unfavourable cases for obtaining a left graft are the presented cases with a magistral pattern of biliary drainage due to the larger number of separate segmental ducts entering from different directions.

Lateral tributaries of the created left lobe duct show possible neighbouring parenchymal zones that would be of compromised biliary drainage in some liver diseases.

From the wide spectrum of diseases where liver transplantation has been indicated, Elsayes *et al*., 2006, by applying MR and MRCP technique evaluated the findings of inflammatory fibrosis and destruction of intra and extrahepatic ducts in primary sclerosing cholangitis in middle-aged patients.

Sclerosing cholangitis in children may be presented as chronic hepatitis or it could be clinically deaf, and in therapeutic trials it includes liver transplantation – Kostovski 2008.

Weitzke-Braun, 2006, presented their different approach to adult-to-adult right lobe living donor liver transplantation in their comparative study of ERC and standard MRC used in the process of evaluation of candidates selected for transplantation.

Conclusion

Biliary drainage of the left liver lobe interpreted in view of the pattern and level of convergence of segmental ducts in the left lobe (lateral) duct and the drainage area of the lobe duct, has pointed out to important variations and differential drainage areas that, in addition to the left lateral sector, also partially include the medial left sector, the left portion of segment 1 and subsegment 9 "b" from the right dorsal sector.

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Резиме

ЗНАЧАЈНИ ВАРИЈАЦИИ НА БИЛИЈАРНАТА ДРЕНАЖА ОД ЛЕВИОТ РЕЗЕН НА ЦРНИОТ ДРОБ

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Апстракт: Билијарната дренажа на левиот резен од црниот дроб е проучувана од аспект на актуелните хируршки трендови за користење лев црнодро-

бен графт од родителски жив дарител во тек на црнодробна трансплантација. За таа цел, на 13 акрилни одливки од портно-билијарните елементи на црниот дроб се детерминирани варијации во начинот и нивото на спојување на сегментните канали во лев лобарен (латерален) канал во однос на главните портни стебла. Забележани се удвојувања на каналите од сегментите 2 и 3; спојување на канал од левото порцио на сегментот 1 со канал од сегментот 2; спојување на удвоен лев медијален канал со канал од сегментот 3 и магистрален начин на последователно вливање на сегментни канали не само од латералниот туку и од медијалниот сектор, како и од левото порцио на сегментот 1 во канал кој започнал од сегментот 3.

Земајќи ги во предвид и бочните притоки на левиот лобарен канал кои ги опфаќаат сегментот 2, левото порцио на сегментот 1 и супсегментот 9 "b" од десниот дорзален сектор може да се укаже на неповолностите за добивање на лев лобарен пресадок.

Клучни зборови: црн дроб, лев резен, анатомија, жолчни канали-варијации, трансплантација.

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