

# History of pioneers in “anatomical right hepatectomy”

— the East meets West 東会合西 —  
Liversurgery 肝臓外科

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## Liver anatomy

Glisson  
Rex / Cantlie  
Healey & Schroy  
Couinaud  
Hjortsj   
Cho & Ryu

## Anatomical liver resection (identification)

Right side  
Left side  
Section/Segment (or subsegment)

# Right hepatectomy

## Preoperative managements

PVE (PTPE/TIPE)  
PV ligation  
HAE  
ALLPS

## Vascular control

(Ischemia · Congestion)

In-flow

Extra- (Glisson's pedicle)

Individual transection

Pringle/Semi-clamp/non-Pringle

Out-flow

THVE

IVC clamp

Position (Reverse Trendelenburg)

Anesthetics (CVP)

## Approaches

Mobilization

Thoracic (thoracotomy)/ Non  
Incision

Anterior approach

Hanging (lifting) maneuver

Laparoscopic

Position

## Others

# Concept

To clarify priority or pioneer with respect to issues of operative procedures by the official documents, published in not only English but also **non-English languages**

Particularly, to reveal the hidden history of great works for liver surgery, not published in English articles as well.

# Inclusion criteria, EMW project

- First priority or pioneer
- Post-1945 , basically
- English and non-English
- Any printed articles or documents
- Subject; succeed, safety, efficacy, popularization
- Expert's opinion



# Search & Judgement

Search (Sept. 2015 - May 2017)

Search engines, National librarian, Expert's provide  
(Medical web-serches, Google, Ichu-shi (JPN))

Articles, Texts

English/ non-English (JPN, French, German....)

Obtained supervisor's (expert) advice or comments

Prof. S.M. Strasberg (USA), Prof. T.L. Hwang (Taiwan),

Prof. C.M. Lo (Hong Kong) , Prof. N. Kokudo (Japan),

Honorary prof. M. Makuuchi (Japan).

Honorary prof. T. Takada (Japan),

Prof. & president M. Yamamoto

# Definition of right and left liver

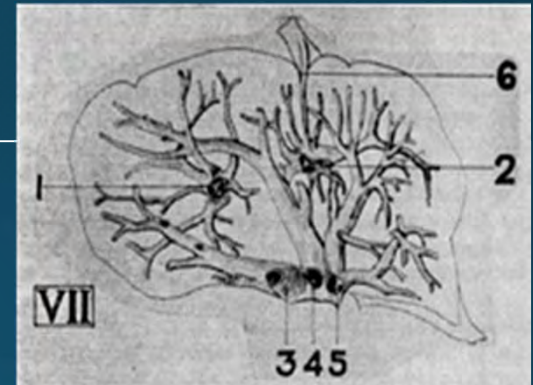
- H. Rex (Czech, German); Intra-hepatic vasculatures (1888)
- J. Cantlie (Scotland) ; Border by blood supply (1898)

**“ Rex-Cantlie’s line (or the midline)”**

## Key of surgical anatomy

- **F. Glisson**; vasculo-biliary sheath (1654)
- **Ton That Tung** & J. Meyer-May (Vietnam); portal and hepatic venous systems (in French, 1939)  
Liver anatomical resections (1962,1979)
- Healey JE & Schroy PC (USA); Portal system, falciform lig. (1953)
- Claude Couinaud (France) ; Portal system (in French, 1954, 1989)
- IHPBA 2000 (Brisbane) ; Liver Terminology (HPB, 2000)

S.M. Starsberg, J. Belghiti and P.A. Clavien



## SHORT PAPERS

### THE SURGICAL TREATMENT OF HEPATIC LESIONS

BY WILLIAM P. LONGMIRE, JUN., EDWARD P. PASSARO, JUN., AND WILLIAM L. JOSEPH

FROM THE SCHOOL OF MEDICINE, DEPARTMENT OF SURGERY, LOS ANGELES, CALIFORNIA 90024, AND THE SURGICAL SERVICE, WADSWORTH HOSPITAL, VETERANS ADMINISTRATION CENTER, LOS ANGELES

ALTHOUGH resectable hepatic lesions are not as common among the people of Western countries as in some other parts of the world (Berman, 1951), the current literature reflects an increasing interest in the surgical treatment of diseases of the liver and a growing number of reports concerning successful hepatic resections in patients of all age-groups. Clatworthy, Boles, and Kattmeier (1961) reported that primary tumours of the liver are the third most common intra-abdominal neoplasm encountered at the Columbus Children's Hospital, exceeded only by neuroblastomata and Wilms's tumours.

Langenbusch (1888), Tiffany in 1890 (Keen, 1892), and Lückes in 1891 (Keen, 1899) performed successful resections of liver tumours. Anatomic hepatic lobectomy was developed by Wendell (1911), who described a right lobar hepatectomy with individual ligation of hilar structures, a technique not unlike that described by Lortat-Jacob and Robert (1952). Pettinari (1955) performed the first successful anatomic left hepatic lobectomy in 1940. These pioneering operations have been followed over the years with continued and increasing interest.

Pack (1962) listed three conditions which have discouraged the surgical treatment of hepatic diseases:—

1. The surgical inaccessibility of the liver.
2. The vital functions of the liver.
3. The hazard of uncontrollable haemorrhage.

The standardization of thoraco-abdominal incisions has rendered all portions of the liver available

in the technique of hepatic resection; however, haemorrhage, subphrenic infection, and interference with residual arterial or venous blood-supply or biliary drainage remain as formidable problems in major hepatic resections.

#### ANATOMICAL CONSIDERATIONS

The details of the intrahepatic architecture have been well presented by Healey (1954), Goldsmith and Woodburne (1957), and Tung (1962). Suffice it to say that all the hilar structures, the portal vein, hepatic artery, and bile-duct, divide into two completely separate systems; one system serves the right lobe, the other the left. These lobes are separated by an interlobar plane which passes caudally through the bed of the gall-bladder to the inferior vena cava groove. The middle hepatic vein runs in this interlobar plane. The left lobe may be divided into lateral and medial segments at the falciform ligament, and the right lobe by an oblique plane into anteromedial and posterolateral segments. The position of the hepatic veins in the interlobar and intersegmental planes has been likened to the intersegmental pulmonary veins. Unfortunately, the friable character of the hepatic vein wall and the tendency of tributaries to sever at the point of confluence make these hepatic veins much more difficult to manipulate surgically than the stouter pulmonary veins.

#### DIAGNOSTIC PROCEDURES

With the exception of diseases that produce ob-



# Anatomical resection

## Left-side

A part of left lobe or left lateral segment

.....Langenbeck (1888) , Keen (1899)

Ton That Tung; left lobectomies (1938, 1939)

~no vascular control (extrahepatic)

- Pettinari(in *Italy*); Left hepatectomy ?(1942)



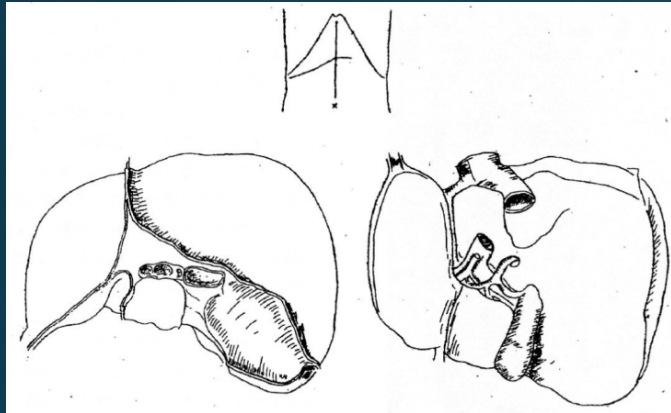
Starzl TE (USA); Left tri-sectionectomy (1982)



# First right anatomical hepatectomy

W. Wendel (German 1911; No precise description, schemes ~ may NOT acceptable)

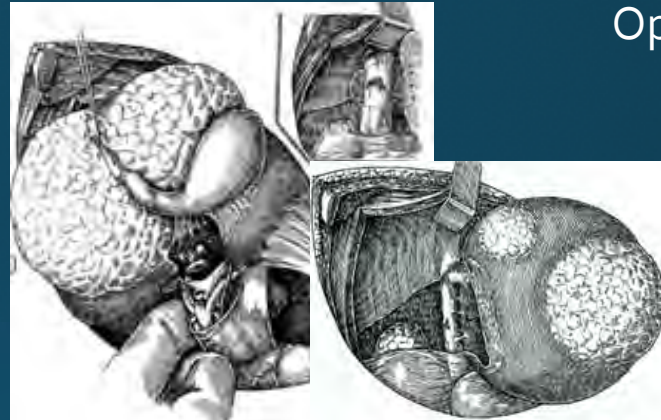
Ichio Honjo( in Japanese 1950,English 1955)



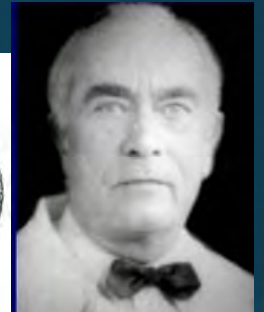
Op. 1949.3



Jean-Louis Lortat-Jacob (French 1952)



Op. 1951.10



Incredibly, breakthrough-operation  
was achieved  
by these great surgeons  
between “East and West”  
at the same period.

# Development (1952~)

RH increased **in the West**

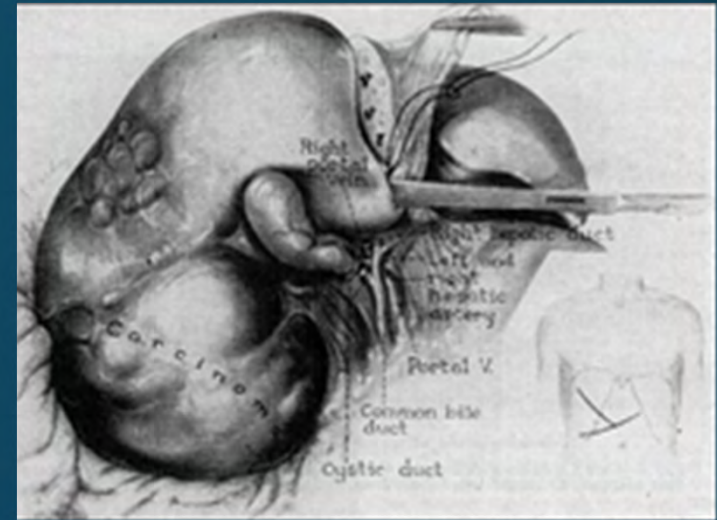
**Pack** (USA, 1953), **Quattlebaum** (USA, 1953)

Mersheimer (1953), Clatworthy (1956)

Caprio (Spain), **Longmire** (USA)

**Fortner** (1969 USA) etc.

**Kajitani** (in **Japanese** 1966)



**In the East** (trans- or extra- fascial access) reported in English

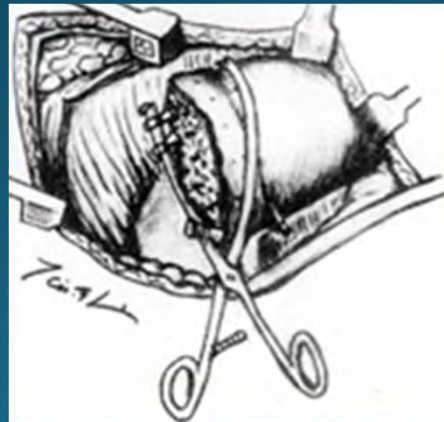
Lin Tien-Yu (Taiwan 1960)

Ton That Tung (Vietnam 1963)

Ligation of intra-hepatic in-flow vasculatures

**Finger fracture** technique

**Lin's clamp** (forceps)

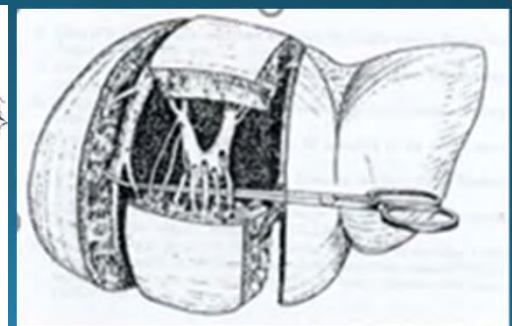
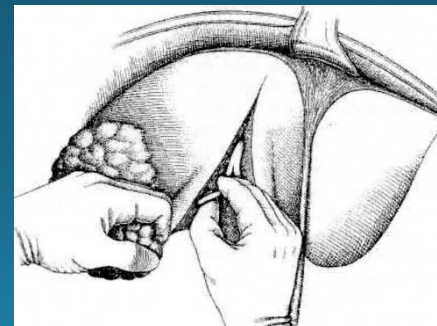


Ligation of inflow-vasculature

Finger fracture technique

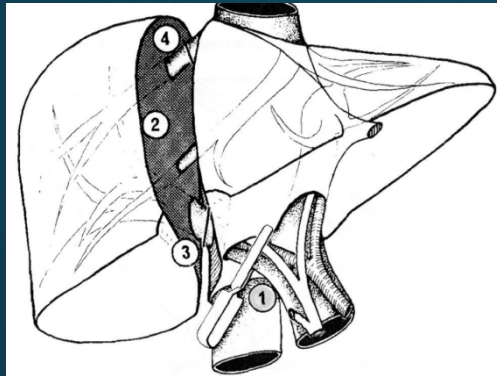
**Hypothermic** perfusion

Expose of **MHV**, **segmental branches**



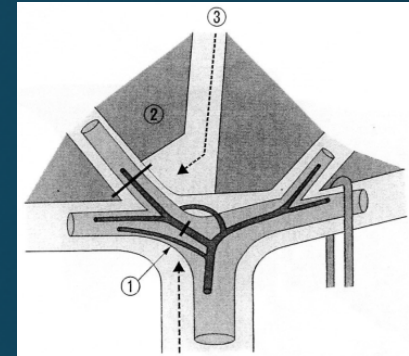


\*Henri Bismuth (France 1982)



**Combined procedure** of preliminary vascular control (Jacob)  
+ parenchymatous transection (Tung's technique)

\*Inflow- occlusion, extra-fascial approach  
RHV transected in the final transection



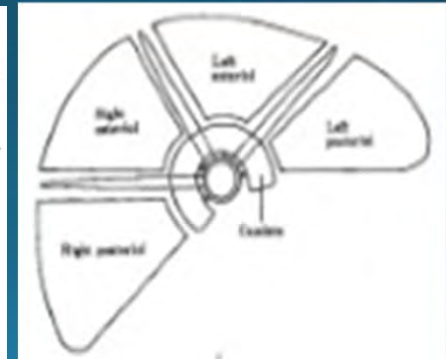
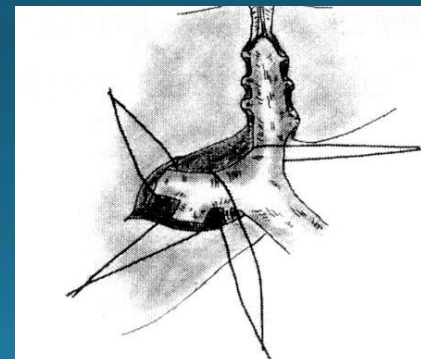
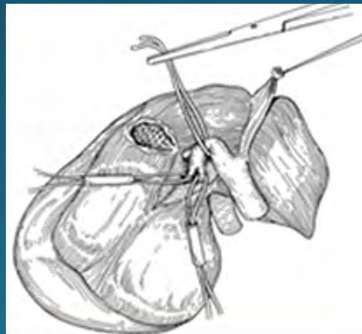
## Vascular (in-flow) control

1) intra-fascial, 2) extra-fascial, 3) extra-fascial and transfissural access

Various anatomical hepatectomy by "Glissonean (or Glissonian) approach"

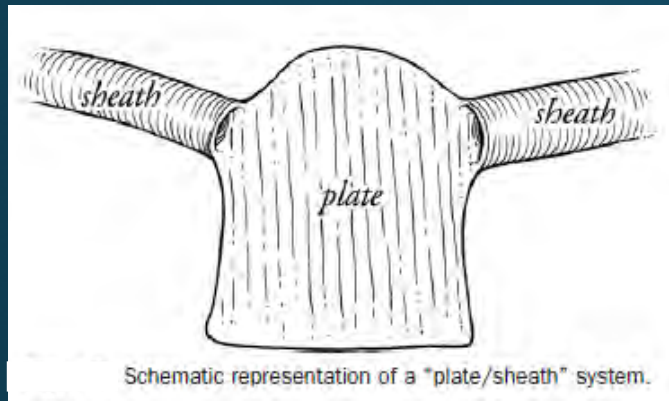
\*K. Takasaki (Japan), Japanese 1986, English 1990

\*E. Okamoto (Japan)  
Japanese, 1986

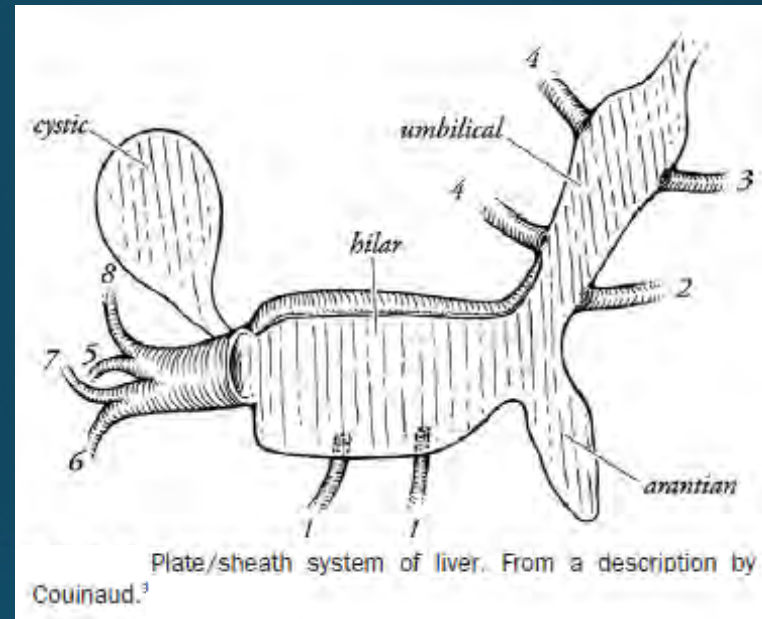




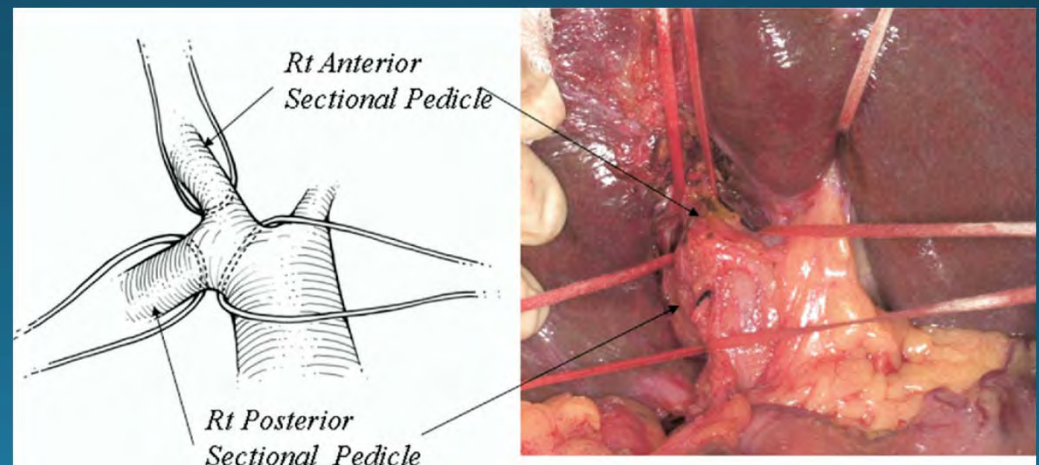
# Couinaud's surgical application (*SM Strasberg, 2001, review 2007*)



**Vasculo-biliary sheaths.** C. Couinaud, ed.  
Surgical anatomy of the liver revisited.  
Paris: Couinaud; 1989

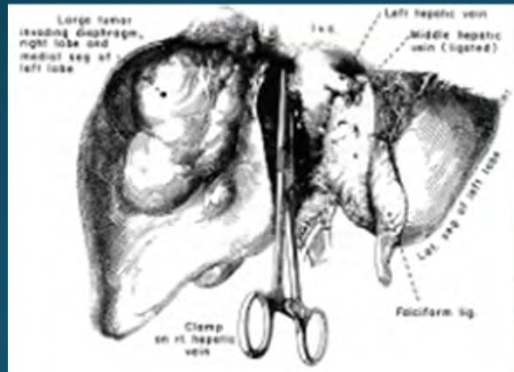
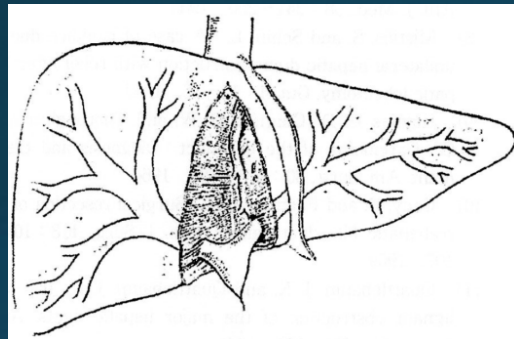
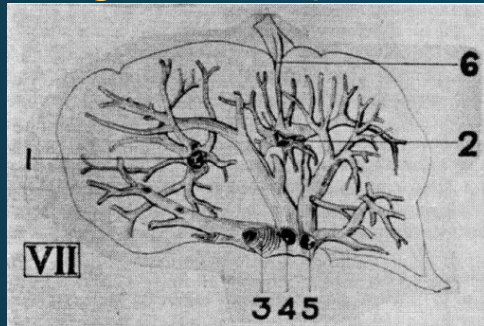


Galperin; Anatomy of cadaver liver, 1989  
Launois; right portal pedicle isolation, 1992  
Batignanis;  
Couinaud+ Launois procedure, 2000

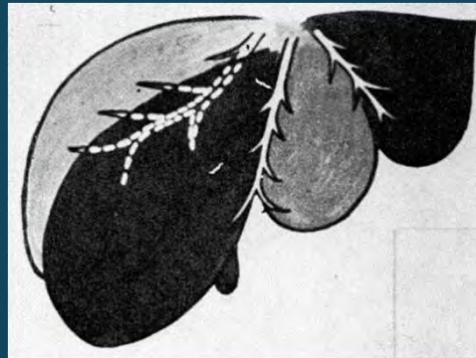


# Anatomical border by HV

Tung's anatomy (1939)



\*H. Hasegawa (Japan; in *Japanese* 1976, *French* 1980)



Middle HV as "intersegmental plane"  
A landmark of both hemi-liver



ST-Fan; "midplane" on MHV (2007)  
to avoid complication and secure  
cancer-free margin.

\*L Blumgart(UK ; 1979)

"liver split" procedure to approach the hepatic hilum by  
exposing the entire MHV between lobes

\*TE Starzl(USA ; 1975, 1980, 1982)

Right trisegmentectomy

Confluence of MHV was finally transected



Basis of the living donor liver Tx.

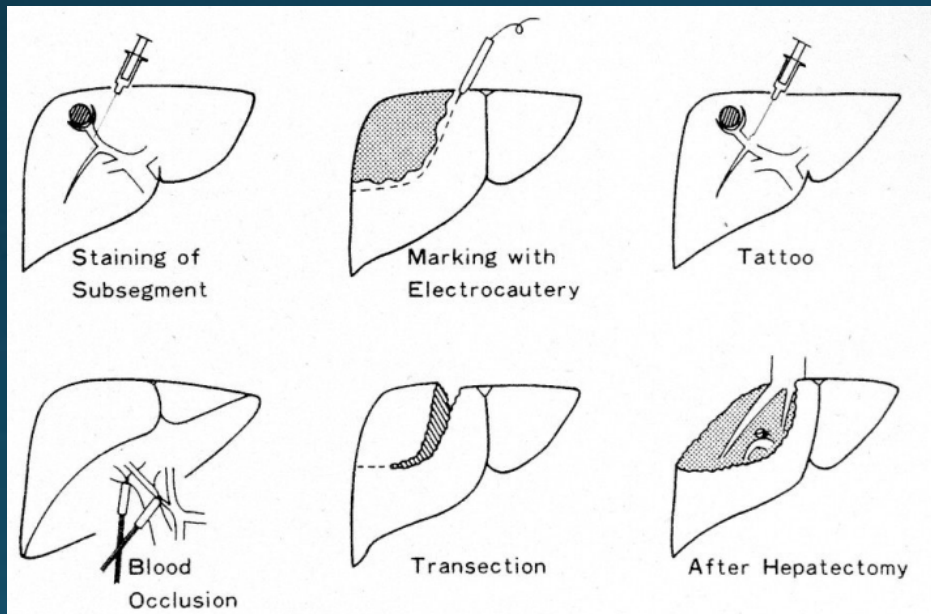
right or left liver; problem of congestion (*Nakamura 1981, Sano 2002*)





# Applications & developments

Anatomical subsegmentectomy, sectionectomy  
Entire exposure of HV and VC front

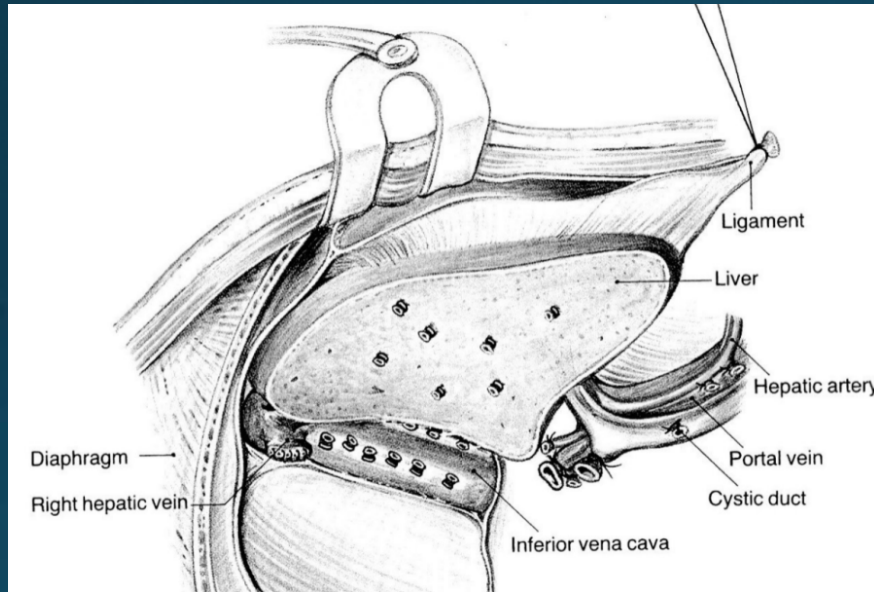


M. Makuuchi (Japan) 1984 - 87

1. US guided puncture and dye injection
2. Hemi-hepatic vascular occlusion

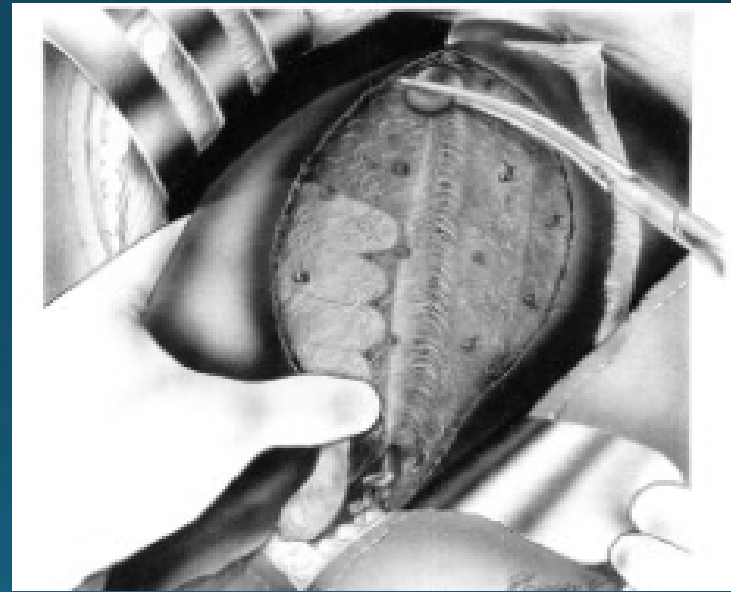


**However.....** Western text in 1990's :  
Scheme of RH;  
Exposure of MHV~ “NOT” described



NJ Lygidakis & GNJ Tygat (1989)

“Hepatoiliary and pancreatic malignancies”  
(Thieme)



A Mazziotti, A Cavallari,  
J Belghiti, EM Gonzalez, L. Hannoun, et al.  
(1997)

“Technique in Liver Surgery”( Thieme)

## Appendix 1.

### Curable major hepatectomy for Liver metastases

#### Colorectal

1940 Cattell; first liver resection for colorectal liver mets.

~ review, Schwartz 1990

1948 Raven

1963 Penden performed right lobectomy

1976 Foster JH, Wilson SM + Adson MA (USA) 60 cases

1977, 1978 Foster

1978 Wanebo HJ: Synchronous hepatectomy

Melanoma, pancreas, stomach, others;

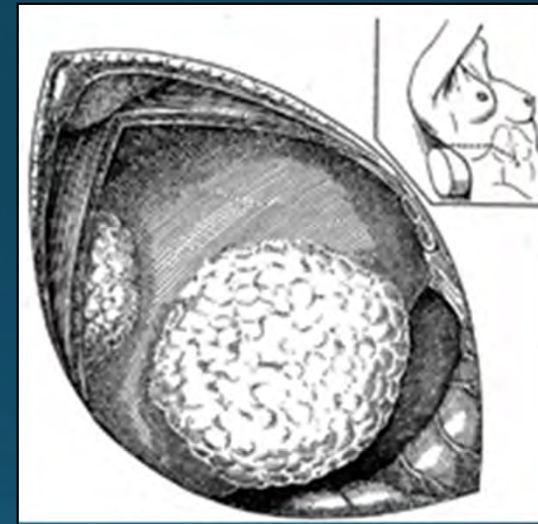
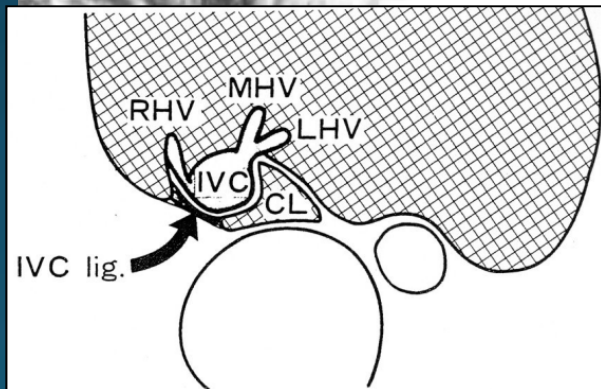
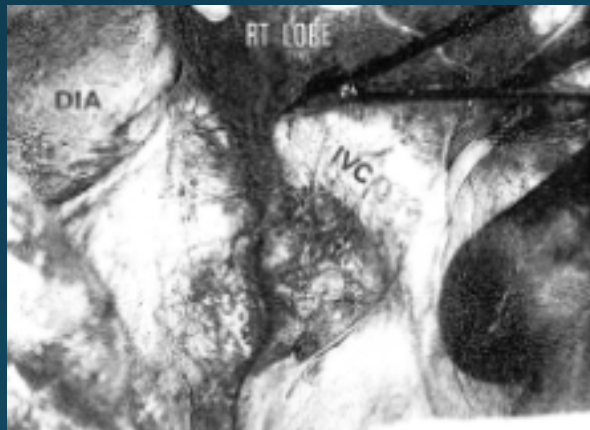
1936 Möller (in *German*) , 1963 Woodington

# Approach

Conventional; 1st step ~ complete mobilization of right liver

*Thoraco-laparotomy; JL Lortat-Jacob (1951)*

*First report; Unknown*



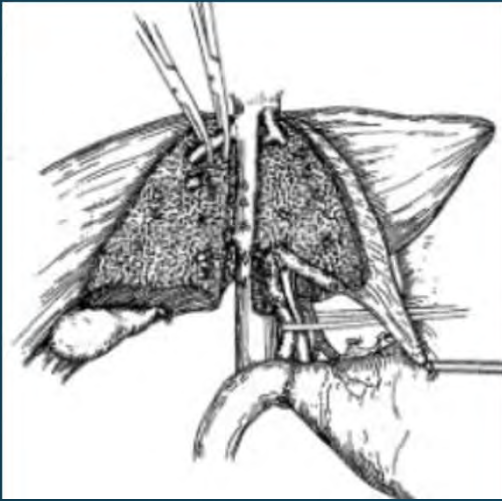
*\* M. Makuuchi (Japan)*

For safe transection, safe approach to right HV (1991)

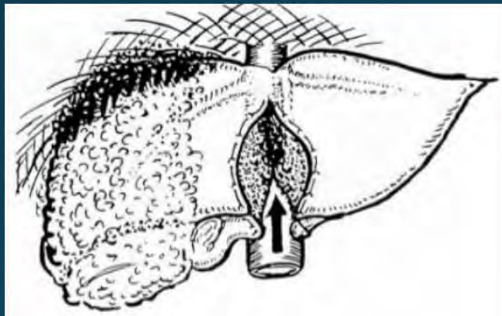
1. J-shape incision with thoracotomy  
To reduce invasiveness of large thoracotomy
2. Identification and transection of IVC ligament



# Anterior approach (AA); alternative option



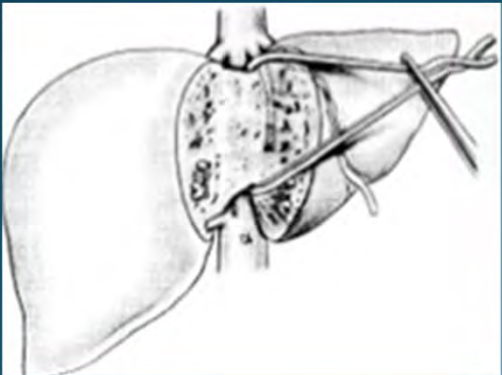
\***K. Takasaki** ( in Japanese 1983-4) ;  
"**Non-touch isolation method**" without mobilization  
for large HCC to reduce massive bleeding



\***K. Ozawa**, Y. Shimahara  
Significance by point of view  
of post-operative hepatic  
function (in English; 1990,  
1996)



**EC Lai** and C. Liu (Hong Kong) ;  
AA reduces blood loss &  
mortality (1996,2000, 2006)



\***J. Belghiti** (France); Liver hanging maneuver for AA



Applied to laparoscopic RH

# Takasaki's first AA ~Video report @ Congress in Japan (1984)

肝癌に対する拡大右葉切除術  
—Anterior approach—

# ~Era of laparoscopic right hepatectomy (2000–)

Hilar approach;

1) Hilar dissection (individual vessel preparation)

(Dagher 2014, Lainas 2015, Palanisamy 2015, Kawaguchi 2016 ...)

2) Glissonian approach - pitfall of injury of contralateral BD (Wakabayashi, Ann Surg 2015)

a) Intrahepatic (Machad 2008, Ogiso 2015, ...)

b) extrahepatic (Cho 2011, Ikeda 2013, Kruger 2016)

Expose of Middle HV;

1) Yes (Ikeda 2013, Palanisamy 2015, Ogiso 2015 ...)

2) No (Sandri 2015, Ratti 2015 ...)

"complete exposure of MHV or vena cava might not be always accomplished" in all

Position;

1) Supine, 2) Semi-lateral decubitus (Machad 2008),

3) Semi-prone (Ikeda 2013)

Mobilization

1) yes (Eguchi 2011, Ikeda 2013)

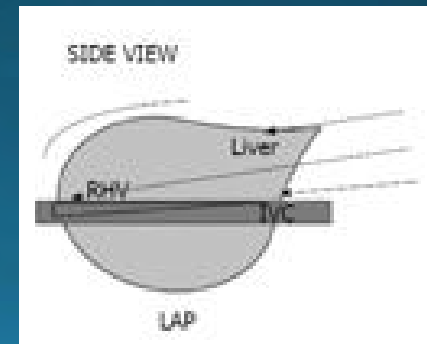
2) no; Anterior approach

Liver hanging

1) Yes (Wakabayashi 2009, Soyama 2012, Dokmak S 2014)

2) No (Cho 2012, Afanch 2013, Herman 2013)

New approach from caudal side



Tomishige (2013)



# Future aspects and story

In the new field of **LAP-liver surgery**, anatomical right hepatectomy has been rapidly progressed worldwide, but *not* majority still.

It remained problems in *future* LAP surgery

- 1) Traditional anatomical concept or approach under the open laparotomy for these 70 years is faithfully achieved *or not*?
- 2) New concept of operative procedures or approaches will develop?

*In a Finale...*